
# *Exploring and profiling of childhood illnesses in informal settlements in relation to flooding: A case study of Barcelona, Cape Town South Africa*



A thesis Submitted to the Faculty of Engineering

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By

**Rumbidzayi. Dorothy. Machiridza**

Supervisor: Warren Smit

# Declaration

This thesis has been completed in partial fulfillment for the award of a Master of Philosophy Degree in Urban Infrastructure Design and Management in the Department of Civil Engineering, University of Cape Town. I declare that this thesis "*Exploring and profiling of childhood illnesses in informal settlements in relation to flooding: A case study of Barcelona, Cape Town, South Africa"* is my own work and has not been submitted for any degree at any other university. All sources used and quoted have been indicated and acknowledged by complete references.

Signature: _____ Date: _____

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## Abstract

INTRODUCTION: A significant number of studies have documented illnesses that follow flooding as a result of people coming into contact with contaminated water. Floods cause health risks by exposing children to bacteria, protozoa, viruses and fungi through contaminated water, contaminated household items, dead animals and mould, as a result of inhalation, ingestion and wound infections. This study focuses on the impacts of flooding on child health in the informal settlement of Barcelona, Cape Town. The health outcomes of flooding are conceptualized within the vulnerability framework of Turner and colleagues (2003), which explores human vulnerability in terms of exposure, sensitivity and resilience. In addition, the framework reflects global environment change and it powerfully defines the term vulnerability.

OBJECTIVES: There were three main research objectives. Firstly, the research established factors and other stressors that determined the occurrence of water-related illnesses among children in informal settlements as a result of flooding. Secondly, the research explored and identified the flood-related childhood illnesses. Lastly, the research identified strategies households applied in order to protect their children from flood-related illnesses.

STUDY DESIGN AND METHODS: The study was conducted through the administration of 45 questionnaires, 2 focus group interviews and personal observation. The study adopted both qualitative and quantitative methodologies in order to understand the perceptions of what flood-related illnesses were and what caused them. Results from the qualitative research were used to triangulate data from the quantitative research. The integration of both methodologies provided additional solutions to understanding the impacts of floods on child health in Barcelona. Ethics approval was granted by Ethics Committee of the Engineering and the Built Environment Faculty at the University of Cape Town.

RESULTS: The research findings suggest that flood-related illnesses in Barcelona were a result of different and interlinking factors. The various factors included poor access to basic services, general poor urban health, and location of the settlement and household hygienic factors. In addition, children were more exposed to risks inside dwellings as compared to risks outside dwellings. Vector-borne illnesses were the least recorded cases. In order to mitigate child illnesses resulting from flooding the households applied both proactive and reactive strategies such as buying of medication before and during flooding, bathing their

children after they finish playing, and sending children to relatives during the flooding period and cleaning dwellings after flooding.

CONCLUSION: Research findings highlighted that there is a significant association between child health and flooding in Barcelona. The types of illnesses that were reported were mainly water-related illnesses, which included respiratory illnesses, gastrointestinal illnesses, skin and ear infections and vector-borne illnesses.

## Definitions:

| Term | Definition | Source |
|---|---|---|
| **Caregiver** | An individual who offers support to a person in some degree of need. | Family Caregiver Alliance (2001) |
| **Child** | An individual who is under the age of 18. | Thomson and Philo (2004); UNCRC (1989) |
| **Health** | A state of complete physical, social and mental well-being not merely the absence of disease or infirmity. | WHO (1948: 200) |
| **Slum/Informal settlement** | A group of individuals living under the same roof lacking one or more of the following conditions: access to improved water; access to improved sanitation facilities; sufficient living area (not more than three people sharing the same room); structural quality and durability of dwellings; and security of tenure. | UN-Habitat (2005: 92) |
| **Vulnerability** | A set of circumstances and characteristics that control the probability of exposure which leads to the predisposition of humans or human systems to a hazard. | Few and Matthies (2006) |

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# CHAPTER 1: INTRODUCTION

## 1.1. INTRODUCTION

Emerging evidence has shown that floods pose risks to human health (Banerjee, 2010; Few et al., 2004; Holloway et al., 2010; Kutto, 2008). Flood waters increase humans' exposure to pathogens and toxins which are detrimental to human health (Few et al., 2004). This is especially true for people living in informal settlements, who are burdened by poor living conditions marked by high population density, lack of access to basic services and poor sanitation, which in turn stimulates a number of health challenges especially among children (Holloway and Roomaney, 2008; UN-Habitat, 2005). The high numbers of child illnesses are correlated to many factors, such as environmental exposure, playing habits, poor nutrition, poor immune systems and other exogenous factors that include poor housing conditions (Banerjee, 2010; Kutto, 2008).

The levels of poverty in most informal settlements and the impacts of flooding have produced virulent epidemics, especially in children, amplifying the prevalence of diarrheal illnesses, respiratory illnesses and skin infections (Rashid, 2009; Sclar, 2005). Some of the above mentioned illnesses are usually not fatal illnesses, however, because there are barriers associated with access to health care, such as proximity and the fact that many informal settlement dwellers only visit health care facilities when it is absolutely necessary, the illnesses may subsequently become debilitating and sometimes fatal (Banerjee, 2010).

An intensive review of academic literature conducted in the early stages of the dissertation, identified literature using the following search terms: informal settlements; informal settlements and health; children's health in informal settlements; flooding; informal settlements and flooding; flooding and health; and children and flooding. The search identified literature that helps in understanding and examining the impacts of flooding on child health in informal settlements, hence the need to review such literature.

Findings from recent flood studies suggest that children are more vulnerable than adults to flood-related health impacts. However, there is little research on understanding how flooding affect children's health. The few available studies indicate that the impacts of flooding on health can include illnesses such as colds, influenza, eczema and coughs (Tapsell and Tunstall, 2001).

High levels of respiratory and gastrointestinal conditions among children were recorded among children in Dhaka slums (informal settlements) (Sverdlik, 2011). However, some of these illnesses can be readily treated or prevented, but they tend to be widespread because of informal settlement conditions (Sverdlik, 2011).

Besides identifying the types of childhood flood-related illnesses this thesis aims to explore the factors that influence childhood flood-related illnesses in Barcelona, South Africa. The thesis specifically examines how household attributes, including availability of basic services, building materials and location of threats, influence the health of children following a flood. It is important to understand and investigate the factors that lead to flood-related childhood illnesses in the hope that health and government officials will develop strategies that will reduce childhood flood-related illnesses in informal settlements.

## 1.2. RESEARCH RATIONALE

The health impacts of flooding on urban children have been a subject of concern to organizations like the World Health Organization (WHO) and Plan (a children's development organization), as many lives are lost to this environmental hazard (Jabry, 2005; Jakubicka et al., 2010; WHO, 2006). For the purpose of this study it is important to understand that childhood is usually a dangerous stage of life (Roberts et al. 1995). Peek (2008) highlights that there is need for more research on children's experiences in disasters with particular attention on how they are vulnerable and their capacities. The deaths of children caused by flooding are only part of the problem. With continued urban growth and lack of local government capacity to manage urbanization, informal settlements are continuing to grow, making these residents, and especially their children, vulnerable to environmental hazards (Davis, 2006).

There is a lack of research on the relationship between floods and the associated effects, particularly children's illnesses. In addition, most research on flooding is concerned with effects such as deaths through drowning, loss of property and accommodation, with particular focus on adults. Moreover, the above effects are the ones most obvious and apparent immediately after a disaster. The issue of child illnesses generally follows days or weeks after flooding, and relatively less research is available, especially on residents of informal settlements. In most regions there is little or no data on the impact of flooding on child health. There is an acute

paucity of literature on the effects of flood on children's health in Southern Africa and this can be very frustrating for the government and policy makers, when providing resources, hence the need to undertake this study. According to DiMP (2005), the relationship between flooding and health in informal settlements calls for further research. Only a small number of international studies, such as Ahern et al (2005); Few et al (2004), have provided evidence on the effects of floods on human health. Studies by Hajat et al. (2005) and Jakubicka et al. (2010) indicate that there is a dearth of plausible quantitative studies that focus on the health effects of flooding. There is lack of knowledge and research concerning the implications of climate change on children and children's health (Holloway and Roomaney, 2008). Obviously, one way to combat this anomaly would be through a study of the causes, temporal and spatial resolution of the incidences of flood-related child illnesses, analyzing perceptions of health risk and coping strategies of affected households in an informal settlement. It is against this background that the current research was conceived, in the hope that it will help address the acute paucity of available literature. This study frames flood health impacts on children not only as a medical problem, but as being integrated with crucial economic, political, social and cultural issues (Few and Matthies, 2006).

## 1.3. RESEARCH QUESTION

The aim of the research is to identify the impacts of flooding on the health of children that live in informal settlements, identify the types of illnesses and suggest measures that can potentially reduce these illnesses or make children less vulnerable. The main research question, therefore, is "*What is the impact of flooding on children's health in the informal settlement of Barcelona, Cape Town*?" To answer this question a set of objectives were selected, and these include:

## 1.4. RESEARCH OBJECTIVES

1. Establishing of factors and other stressors that determine the occurrence or incidence of waterborne illnesses among children in informal settlements as a result of flooding;
2. To explore and identify the flood-related childhood illnesses;
3. To identify strategies households apply in order to protect their children from flood-related illnesses

## 1.5. ETHICAL CONCERNS

The study was approved by the Ethics Committee of the Engineering and Built Environment (EBE) Faculty at the University of Cape Town before going into the field. This was followed by requesting permission from a representative of Slum Dwellers International (SDI) in Barcelona, who also gave approval. The nature of the research was that the caregivers would participate on a voluntary basis. For this reason, consent forms were provided to the caregivers to inform them of the nature of the research. Furthermore, it informed the caregivers that participating in the research was on a voluntary basis. This was made very clear to the participants. The caregivers were informed that if they refused or chose to discontinue with the research there would be no repercussions. The caregivers were assured of anonymity in the dissertation and anything that will be written concerning this issue, and they were urged to express themselves freely (Beazley et al. 2009). For those that volunteered to help with the research, they were informed that their real names will not be used for confidentiality reasons. Thus this was achieved through the use of pseudonyms in the writing up of the research.

Another ethical concern that was considered was that of positionality and the imbalances of power that were found between the researcher and the caregivers. Researchers like Barker and Smith (2001) assert that reflexivity and cautionary practice should be employed in order to protect the participants. In particular, in studies involving children, the research should not be affected by the positions that the researcher assumes in the field, thus potentially becoming biased. For this reason, this research created a friendly atmosphere for the caregivers.

Data that was obtained from the research was only used in the research and kept in a safe place. Lastly, when the final research has been compiled a copy will be sent to the local committees in Barcelona that participated in the research.

## 1.6. LIMITATIONS OF THE STUDY

There were several limitations that were identified during the research.

There was a large possibility of respondent bias, in terms of how the participants answered the focus group interviews and the open-ended questions on the questionnaires. The participants might have produced inaccurate information because some of the participants were aware that

they were being recorded, thus falsifying some of their answers in order for them to please the researcher and the other participants rather than what they actually experienced. However, the researcher tried to reduce this risk in the focus group interviews by applying the triangulation process, where key informants were further asked to verify some of the issues. In addition to this, the questionnaires were administered individually with no friends and relatives of the participants around.

Another limitation that was identified was regarding the type of sampling method. The researcher however tried to minimize the risk by trying to include all types of caregivers, by conducting some of the questionnaires after working hours. Likewise, focus group interviews were conducted during weekends when the working caregivers were expected to be home.

In addition, valuable information might have been lost through translation from Xhosa to English and English to Xhosa, because the researcher was not fluent in Xhosa. However, a translator minimized this during the focus group and during the administering of questionnaires.

Recall bias was another limitation. Some of the caregivers found it very difficult to recall the type of flood-related illnesses that their children incurred following a flooding period. Equally important, the researcher was aware that she was dealing with both self-reported diagnosis and clinically diagnosed illnesses, thus the researcher focused intensively on the types of flood-related illnesses

## 1.7. THESIS ORGANIZATION

This thesis has been structured into six different chapters. The first chapter introduces the key concepts of the thesis to the reader, with a synopsis of the thesis. The second chapter provides a literature review of existing literature, it discusses literature on informal settlements, floods, floods and health and flooding and children. Chapter Three outlines the research context of the study. The research methodology is presented in Chapter Four, which gives a detailed account of the data collection process, the type of instruments employed and the data analysis. In this same chapter, the conceptual framework of the study is laid out. The research findings of the study are presented in Chapter Five. The chapter discusses the findings and further examines the findings

applying the conceptual framework that was introduced in Chapter Four. Finally, chapter Six discusses the research findings and gives a conclusion of the study (refer to Table 1).

**Table 1: Organization of thesis**

| Research logic | Organization of thesis |
|---|---|
| **Chapter 1:** *Research problem* | Introduction and justification of research problem, research rationale, objectives. |
| **Chapter 2:** *Literature review* | Literature review. |
| **Chapter 3:** *Research context* | Outlining of the research context of the study. |
| **Chapter 4:** *Design* | Research methodology applied to the research in order to examine the research question and introduction of the conceptual framework. |
| **Chapter 5:** *Evidence* | Presentation of research findings and the application of the conceptual framework to the findings. |
| **Chapter 6:** *Conclusions* | Discussion and conclusion of the study and recommendations. |



## 1.8. SUMMARY

The chapter serves to introduce the study to the reader. It outlines the study's aim, question and objectives. It also outlines the study's rationale, with the focus on understanding the impact of flooding on child health in informal settlements, through a case study of Barcelona in Cape Town. In addition, the chapter gives an outline of the ethical considerations and the research limitations. Lastly, it gives a brief outline of how the thesis is organized.

# CHAPTER 2: LITERATURE REVIEW

*"The cities of the future, rather than being made out of glass and steel as envisioned by earlier generations of urbanists, are instead largely constructed out of crude brick, straw, recycled plastic, cement blocks, and scrap wood … surrounded by pollution, excrement, and decay."*

*(Davis, 2006: 8)*

## 2.1. INTRODUCTION

Informal settlements are characterized by inadequate shelter, poor infrastructure and high population densities (Davis, 2006; Gilbert, 2007; Holloway and Roomaney, 2008; UN-Habitat, 2003). With such conditions, these populations are greatly exposed to floods, fire, crime and diseases, with children being the most susceptible group. This section reviews literature on informal settlements, informal settlements and health, child health in informal settlements, urban flooding, informal settlements and flooding, flooding and health, and on children and flooding.

## 2.2. INFORMAL SETTLEMENTS

Defining the word "slum" has proven to be problematic (Gilbert, 2007; UN-Habitat, 2003). However, UN-Habitat (2005: 92) suggests a working definition of a slum household as:

> …a group of individuals living under the same roof lacking one or more of the following conditions: access to improved water; access to improved sanitation facilities; sufficient living area (not more than three people sharing the same room); structural quality and durability of dwellings; and security of tenure.

In the global south the most common type of slums are the "informal settlements" that mirror urban poverty in developing world cities (UN-Habitat 2003). Work by Gilbert (2007), highlights that the term "slum" is too broad a term to be of much practical use, and I therefore focus on a particular type of slum, "informal settlements". The key characteristics of informal settlements are defined by the United Nations (1997) as a group of housing units that have been built on illegally occupied land by the occupants and where the method of building does not comply with the building regulations. Thus this paper will use the term "informal settlements" to describe settlements whose residents do not have legal security of tenure and do not have dwellings that

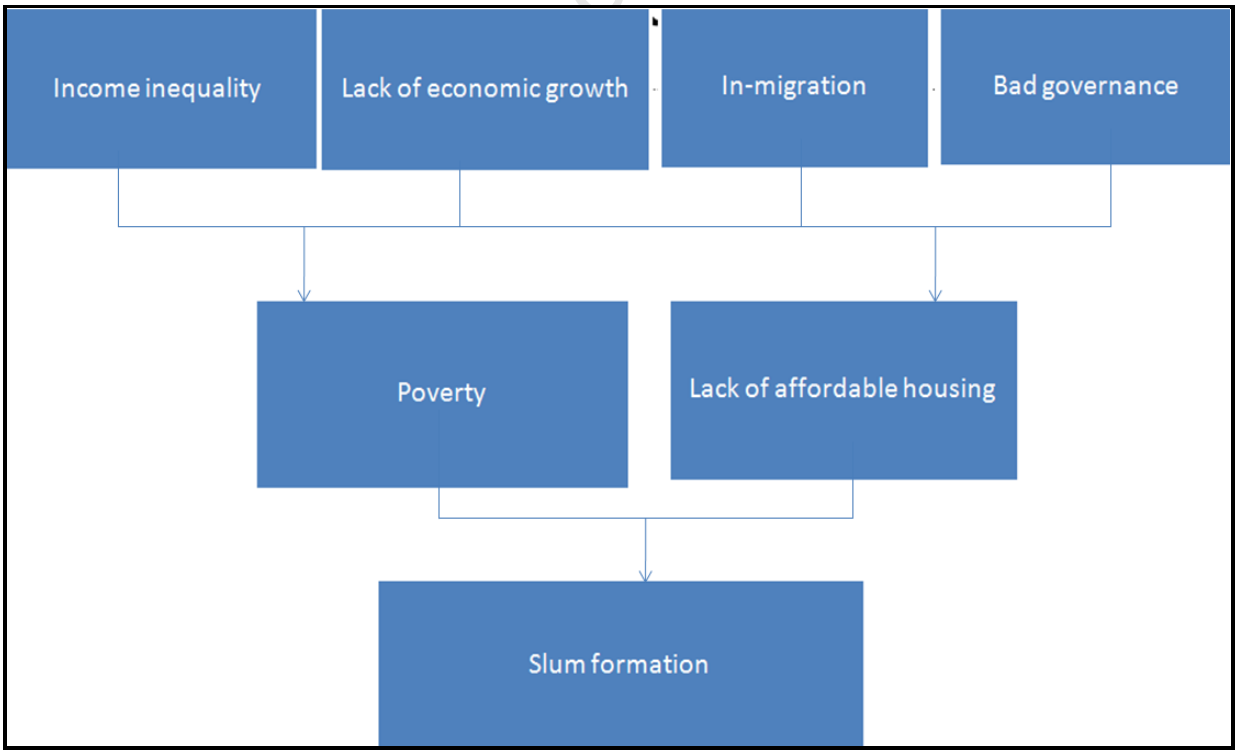
comply with planning and building regulations (and which therefore generally lack adequate services).

### 2.2.1. Views on formation of informal settlements

Iacoboaea (2009) and UN-Habitat (2003) indicate that informal settlements are a result of deep poverty, unfair policies, lack of proper urban planning, impractical regulatory frameworks, and fragile institutional capacity (see Figure 1). This then is exacerbated by the inability of governments to implement programmes that offer affordable houses for low income people in the city, together with various macro-economic factors (Mehta and Dastur, 2008; Ooi and Phua, 2007). Davis (2006) supports the poverty and inequality view and argues against institutions like the World Bank and International Monetary Fund (IMF) who support the view that global informal settlements are not a product of inequality and globalization but of bad governance. Davis (2006) indicates that due to the inadequate supply of housing by governments, informal settlement dwellers are forced to build shacks for themselves out of necessity.



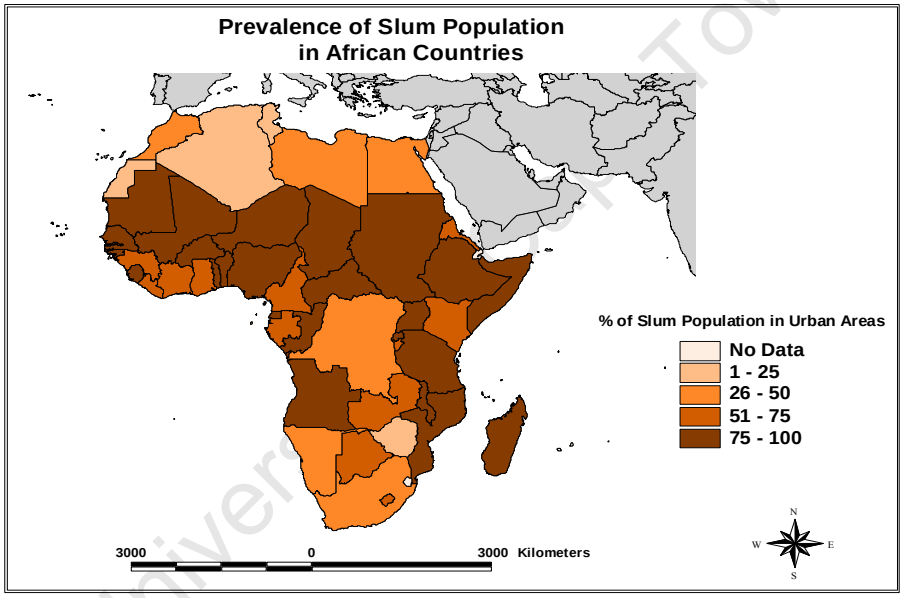
**Figure 1: Formation of informal settlements due to poverty and inequality on a national level (UN-Habitat, 2003)**



### 2.2.2. Populations in informal settlements

There are difficulties faced in estimating the number of people who live in informal settlements. However, UN-Habitat (2012) estimates that about 860 million people lived in informal settlements in developing countries in 2012 (about 33% of all urban residents in developing countries). The highest proportions of informal settlement dwellers are generally found in Africa (see Figure 2). For South Africa, it was estimated that about 7 million people - about 23% of urban residents - lived in informal settlements in 2012 (UN-Habitat, 2012).

**Figure 2: Map of the prevalence of informal settlements in Africa (UN-Habitat, 2003)**






## 2.3. HEALTH IN INFORMAL SETTLEMENTS

Informal settlements are categorized as places that have one or more of the following shortcomings: lack of access to improved water supply; lack of access to improved sanitation facilities; insufficient living area (more than three people sharing the same room); poor structural quality and durability of the dwelling; and lack of security of tenure (UN-Habitat, 2005). The right to adequate housing is a basic human need which has been enshrined in international laws (Kutto, 2008). Housing is linked to having a roof over one's head (Kutto, 2008), but can also be linked to elements such as access to basic services and resources, security and safety (Thiele,

2002). Lack of the aforementioned elements is positively linked to poor health (Fay, 2005). It should be noted that in this study, the WHO definition of "health" is used, defined as "…*a state of complete physical, social and mental well-being not merely the absence of disease or infirmity* (WHO, 1948: 200).

### 2.3.1. Determinants of informal settlement dwellers' health

Rashid (2009) highlights that macro-political and economic conditions combined with other elements, negatively impacts the ability of poor urban people to improve their health. This includes "… *overall, a lack of political commitment towards alleviating the conditions of the urban poor, abject poverty, high unemployment levels and lack of basic services*" (Rashid, 2009: 576). If policies that work towards improving housing conditions and opportunities to earn income are not implemented for the urban poor populations, the health problems in these areas is going to increase, with high morbidity and mortality from "*several communicable and non-communicable health problems and diseases*" (Sclar et al. 2005: 901). Research has shown that health problems in informal settlements result from disparities in the physical environment, mainly lack of sanitary and water supply facilities (Bility and Onya, 2000; Chinyenze-Daniel et al. 1999; Cousins and Lagardien, 2004; Todd, 1996). In addition, other work argues that poor health in informal settlements is exacerbated by lack of services, inadequate shelter of poor quality which is usually overcrowded, and minimal refuse collection and health care services (Davis, 2006; Holloway and Roomaney, 2008; USAID, 2004; Sverdlik, 2011). Similar evidence can be found in the study conducted in Porte Alegre, Brazil by Sattherwaite (2003) which suggests that lack of access to services has a negative effect on health. A study by Saegert et al. (2003) revealed that interventions directed towards urban health improvement can be achieved through changes in housing-related conditions.

Davis (2006) indicates that location is a determinant of the health of informal settlement dwellers. In his work he indicates that informal settlement dwellers all over the world become settlers of floodplains, wetlands, volcano slopes, dump sites and unstable hillsides in the hope of having a roof over their heads. In short, they settle in the most unhealthy, unappealing and perilous places in cities. Informal settlement dwellers are therefore faced with severe weather

events, fires and seasonal floods. Accordingly, Unger and Riley (2007: 1561) state that "… *a slum, by any name, is an unhealthy place to live*."

At the same time, authors like Vlahov et al. (2007) point out that health in informal settlements is shaped by the characteristics of the population: this includes, age, health beliefs, distribution of gender and cultural attitude and beliefs. Women, children and people with compromised immune systems are the most vulnerable and they constitute the highest proportion of the affected (Montgomery et al. 2003). Due to overcrowding in these settlements, infectious diseases such as tuberculosis, measles, colds and cholera tend to spread fast, making children especially vulnerable. This is further exacerbated by environmental conditions such as flooding (USAID, 2004).

Personal behavior is also recognized in some of the litrature (Fay, 2005; Few and Matthies, 2006) as a modifier of health. If people practice good hygiene they are more likely to have a healthy life as compared to those who do not practice good hygiene. The education and awareness of mothers on the importance of hygiene is important and it can be a positive modifier to health, because an educated mother knows when and how to administer techniques such as Oral Rehydration Therapy (ORT) in handling diarrhea, administer follow-up medical checkups, seek appropriate medical care and understand the importance of timely immunization (Banerjee, 2010; Fay, 2005; UNICEF and UNEP, 1990).

Good health services are essential for good health (Vlahov et al., 2007). However, in informal settlements there are little or no health services available to people because these populations are often deemed to be illegal (Vlahov et al. 2007). Fay (2005:180) highlights that "…*there is no consensus in the literature on the extent to which consumption of health services improves health outcomes*", but argues that access to quality health care can save the lives of people, for example, through the administering of antibiotics and ORT.

## 2.4. CHILD HEALTH IN INFORMAL SETTLEMENTS

According to the United Nations Convention on the Rights of the Child (UNCRC), a child can be defined as a person who is under the age of 18 (Thomson and Philo, 2004; UNCRC, 1989). Children are "… *disproportionately affected by many of the environmental challenges [in] poor*

*urban settlements*…" as a result of their physiological vulnerability and compulsion to play even in hazardous environments (Garenne, 2010:466; Sverdlik, 2011). Overwhelming risks to children's health in informal settlements originate from minimal access to health care, water, inadequate sanitation and housing which can also be linked to the widespread of extreme abject poverty in informal settlements (Sverdlik, 2011). Sverdlik's research findings indicated high levels of respiratory and gastrointestinal conditions among children in informal settlements.

A study conducted in Bangladesh on housing conditions and accessibility of hygienic toilet facilities and safe drinking water indicated that such services were important for child survival (Islam et al. 2008). Similar evidence can be found in the study by Macassa and colleagues (2004), who conducted a study in Malawi on child health with regards to unavailability of toilet facilities and safe drinking water. Their results indicated that children living in households without flush toilet systems and piped water were at a higher risk of ill health or death. In the report on the progress towards the child mortality Millennium Development Goal by Fotso et al. (2007), they highlight that levels of child mortality were closely related to accessibility of safe drinking water.

Studies conducted in Niger and Ethiopia indicate that children are burdened by "slum diseases", which result from lack of proper refuse collection, sanitation and lack of proper drainage, as compared to the other populations (Ramin, 2009:886). The results of the study highlights that the child mortality rates are 2.5 times greater in informal settlements as compared to other places in the city (Ramin, 2009).



## 2.5. FLOODS

According to the IPCC (2012) a flood is defined as "*the overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas that are not normally submerged*". Floods are experienced in both developed and developing countries, and brings about damage to infrastructure, utility works, household assets and poor health, as highlighted in Table 2 (Holloway et al. 2010; Holloway and Roomaney, 2008; Jha et al. 2012). Floods are influenced by numerous characteristics of precipitation, which include duration, intensity, amount, timing (IPCC, 2012). In urban areas especially informal settlements such characteristics

are exacerbated by soil character and status, urbanization, and land use, making it problematic to assess the causes of floods (IPCC, 2012; Zevenbergen et al., 2010).

**Table 2: Impacts and sources of flood risk in informal settlements (Holloway and Roomaney, 2008)**

| Broad source of hazard | Hazard | Factors increasing risk | Effects |
|---|---|---|---|
| Poor drainage | Ponding | Poor drainage around communal water taps<br><br>Shallow, hand dug informal drains between houses<br><br>Blocked drains<br><br>Clogged drainage ditches | Health problems, particularly among children who play in the water, and related costs<br><br>Missed school or work days |
| | Surface runoff | Inadequate drainage alongside hardened surfaces such as roads<br><br>Structures in close proximity to hardened surfaces | Health problems, particularly where waste is washed into homes, and related costs<br><br>Missed school or work days<br><br>Damage to structures<br><br>Damage to and loss of assets, documents and possessions |
| Structural problems | Seepage | Structures in close proximity to wetlands and water bodies<br><br>Home foundations below ground level<br><br>Poor building materials<br><br>Inadequate weather proofing | Damage to and loss of assets, documents and possessions<br><br>Health problems, as people become ill from damp and cold conditions, and related costs |
| | leaks | Poor building materials<br>Inadequate weather proofing | Missed school or work days |
| Flood exposure factors due to locations and surrounding | Coastal flooding | Structures built on sand dunes close to coast<br><br>Disturbance of natural water drainage and flow patterns | Injuries and death and related medical costs<br><br>Homes completely or partly washed away<br><br>Damage to and loss of assets, documents and possessions<br><br>Damage to and loss of infrastructure<br><br>Negative effects on businesses and industries, particularly in the |

| | | | |
|---|---|---|---|
| | Riverine/estuarine flooding | Structures in close proximity to water bodies<br><br>Structures built in dry water courses<br><br>Disturbance of natural water drainage and flow patterns | tourism sector<br><br>Isolation of communities as bridges and roads are damaged or washed away<br><br>Injuries and deaths and related costs<br><br>Homes completely or partly washed away |
| | Mud slides and debris flows | Disturbance of natural water drainage and flow patterns<br><br>Destruction of vegetation on mountain slopes | Damage to and loss of infrastructure<br><br>Damage to and loss of assets, documents and possessions<br><br>Negative effects on businesses and industries |



Undoubtedly, the urban environment and the natural environment are both subjected to the same natural forces. However, the existence of urban settlements increases both the extent and impacts of flooding (Jha et al. 2012). In particular, the volatile weather patterns are continuing to affect slum dwellers (Few, 2004; Holloway et al. 2010). There are two main ways that urbanization can increase risk of flooding (the processes can either be integrated or isolated): urban growth in floodplains and low-lying coastal areas; and the expansion of the built environment (for example, roads and buildings), resulting in increased run-off of water (Texier, 2008; Zevenbergen et al. 2010).

Urban flooding is a challenge that is being faced by increasing numbers of people, especially the urban poor in informal settlements across the African continent (Douglas et al, 2008). At the same time improper land planning is viewed as one of the causes of urban flooding (Jha et al. 2012), because of the increasing population there is need for more land, and, as a result, people settle in swamps, wetlands, and so on. Naturally, when people settle in swamps and wetlands, this results in the "*destruction of the flood storage capacity of the area*" and changes the flow paths of water (Adelekan, 2010:434; Jha et al. 2012). Wetland vegetation and trees slow down the speed of floodwaters (Jha et al. 2012). Such scenarios, coupled with dense population, overextended drainage capacity and lack of adequate shelter and basic services (such as water and sanitation) can be devastating. Poor drainage systems coupled with high intensity rainfall in urban areas may therefore result in flooding. In addition, it is a common scenario that when it

floods in low-lying areas, the flood waters will be contaminated with sewage fluids (Jha et al. 2012).

Lastly, urban flooding has vast impacts on the poor urban population. It destroys and reduces access to health care facilities, increases water borne diseases, and worsens the sanitation conditions of informal settlements (Few and Matthies, 2006; Ivers and Ryan, 2006). For this reason, urban flooding restricts the slum dwellers of Africa from escaping from poverty and "*…it stands in the way of the Millennium Developmental Goal (MDG) of achieving significant improvement in the lives of the urban dwellers*" (Adelekan, 2010:434).

### 2.5.1. Environmental health impacts and flooding

A Scottish philosopher named David Hume of the 18th-century indicated that "*causality is induced logically, not observed empirically. Therefore we can never know absolutely that exposure X causes disease Y*" (Gerstman, 2003:33). Hence, it is important to understand that the origin of a disease is "*an occurrence, state or characteristic preceding a disease without which the illness episode either would not have transpired at all or might not have occurred till some later time*" (Gerstman, 2003:33). Thus, on a population basis, we expect that a change in the level of a causal factor will be accompanied by an increase (or decrease, since in some instances causal factors are preventive). In the prevalence of flood-related illnesses, (all other things being equal), it is expected that if the causal influence is moderated or eradicated, it may lead to the decline in the severity of the frequency of disease. For this reason, the floods in informal settlements accompanied by factors such as behaviors, personal characteristics, lack of basic services and other susceptibility-related elements that impact the likelihood or severity of disease may increase the likelihood of childhood flood-related illnesses.

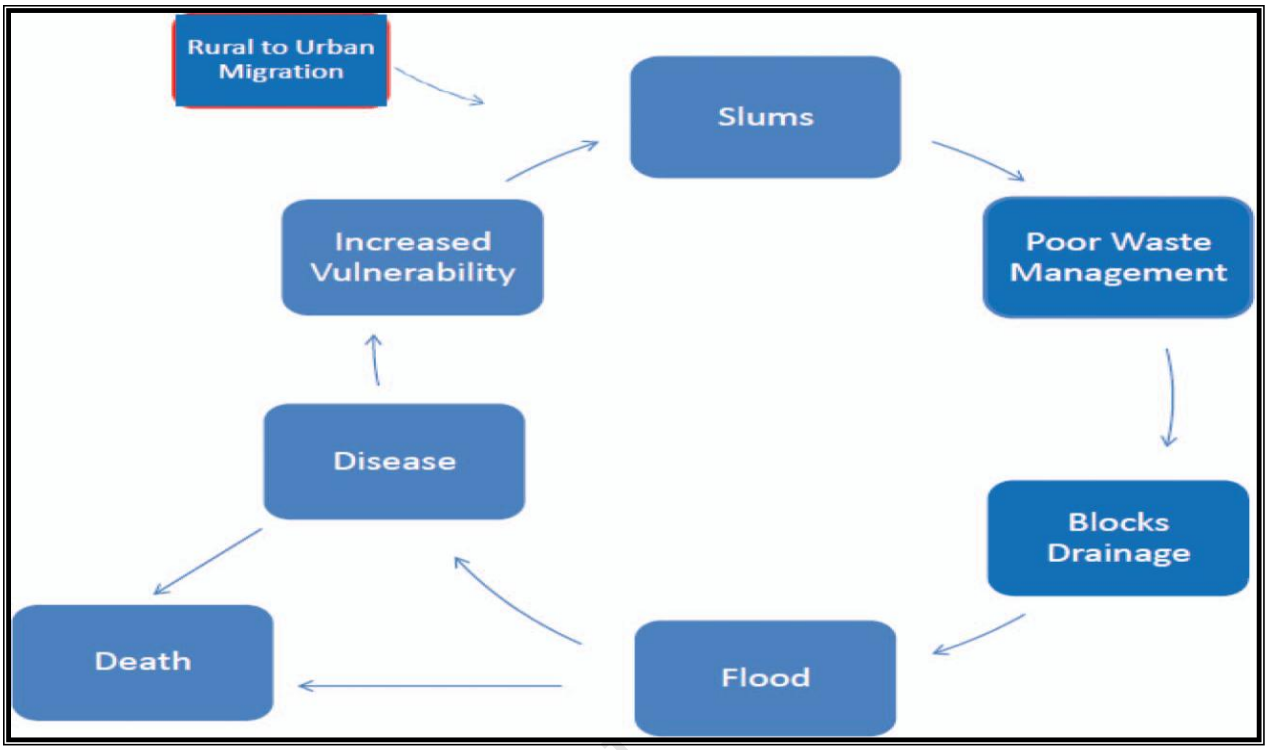
There is limited research on the impacts of flooding on health. Recent studies conducted by Few and Matthies (2006) and Holloway and Roomaney (2008) indicate that long-term health risks that are posed by floods tend to penetrates deeper into their daily lives as compared to the physical life threats that are brought about by the floodwaters. Floods carry and deposit waste-contaminated waters into living spaces (Few and Matthies, 2006:2). In areas with poor sanitation and poor drainage, urban flood runoff mixes with excreta, thus increasing the chances of people coming into contact with fecal pathogens, increasing the risk of contracting waterborne diseases.

A study by Parkinson (2003) points out that fecal contaminated wet soils in flooded and poorly drained areas, that are a result of poor sanitation, offer perfect environments for the eggs of parasitic worms, such as roundworm and hookworm, which are well known for causing debilitating gastrointestinal infections (Kolsky, 1999). In addition, open drainage waterways are potential sources of contamination and illnesses (Cairncross and Ouano, 1990). Unfortunately, children are the most affected populations because children play in and next to this contaminated water. The infections are a result of numerous agents, including protozoa, bacteria, viruses and fungi (Fewtrell and Kay, 2006). The aforementioned agents are transmitted through different exposure routes such as inhalation, ingestion, insect transmission and wound infection. The severity of the infection varies from sub-clinical to mild or fatal (Fewtrell and Kay, 2006).

### 2.5.2. Health impacts of flooding on underprivileged urban communities

The impacts of flooding on health can be categorized as direct or indirect (Du et al., 2010; Few et al., 2004). Direct impacts are mainly a result of direct exposure to the flooded environment and the contaminated water as a result of poor waste management and poor storm water drainage system (see Figure 3). The consequences vary from injuries, drowning, hypothermia and chemical contamination (Du et al. 2010; Watson et al. 2007). The indirect impacts are connected to the risks and damages caused by the water on natural and built environments; this includes poverty-related illnesses, malnutrition and infectious diseases (Du et al. 2010). The flood impacts on health can be characterized as period-immediate, medium-term and long-term. Such characterization is useful for the implementation of management and development strategies (Du et al. 2010).

**Figure 3: Factors associated with adverse health outcomes in urban floods (Munslow and O'Dempsey, 2010)**




Flood impacts on health are significant, especially in developing countries (Kolsky, 1999; Hunter, 2003). According to Few and Matthies (2006), populations in countries of Africa, Latin America and Asia are more vulnerable to health risks associated with floods as compared to other continents, because they lack strong adaptive measures. Floods increase the chances of contact with waters infested with disease vectors, toxins and pathogens (Few et al. 2006). There is evidence of disease outbreaks following floods (Hunter, 2003; Ivers and Ryan, 2006), such as the malaria and diarrheal disease outbreaks following floods in Khartoum (Few and Matthies, 2006; Greenough et al. 2001).

Floods may lead to outbreaks of diseases that are associated with direct contact with dirty floodwaters (cholera, typhoid fever and hepatitis), vector-borne diseases (including malaria and dengue fever) and illnesses that result from mould growth in the living environment (Few et al. 2004; Few and Matthies, 2006; Hunter, 2003; Ivers and Ryan, 2006).

Cairncross and Ouano (1990) claim that environmental health problem, such as blocked drainages, the lack of adequate sanitation and the dumping of solid waste, enhance the

prevalence of infectious diseases. A study that was conducted in Manila, Philippines, by Zoleta–Nantes (2000) suggests that people who are affected by floods are at risk of respiratory infections, gastro-intestinal illnesses, skin allergies, and children are at high risk.

Flood health impacts are exacerbated by the fact that informal settlements are unplanned settlements, densely populated, and are not structured or engineered in a manner that allows the drainage of surface and ground waters (Holloway and Roomaney, 2008 and Ziervogel and Smit, 2009). Thus, such living conditions pose health risks to the slum dwellers especially children (Holloway and Roomaney, 2008; Ziervogel and Smit, 2009). In addition, vulnerability can be increased by collective poverty, reflected in issues like lack of proper sanitation, low levels of piped water and lack of proper housing (WHO, 2005).

### 2.5.3. Children and floods

An estimated 242 million people in the world were affected by disasters during the period from 1991 to 2000 (Kaufmann et al. 2002). About 76.5 million of the 242 million people were children below the age of 15 (Kaufmann et al. 2002; Waddell, 2010). Kaufmann et al. (2002) indicate that 75 million of these children lived in developing countries. Importantly, Bartlett (2008); Manyena et al. (2008) reveal that during and after disasters, children and women have high numbers of illnesses and mortalities as compared to men.

Jabry (2005) highlights that children are brought into the picture during and after disasters as symbols of suffering, as they are shown in media with their bodies covered with flies in order to persuade the public into donating to relief programmes. However, children are often overlooked when it comes to disasters. An example is that of the Bangladesh Disaster Reports of 1998, 1999 and 2000. These three reports barely refer to children, regardless of two of the reports carrying front covers of children swimming in contaminated floodwaters (Waddell, 2010).

#### 2.5.3.1. Effects of flooding on children

Peek (2008) highlights that there are assumptions that indicate that children and adults have the same needs, yet in fact, their needs are different. Waddell (2010: 20) indicates that "*Meeting adults' needs does not automatically meet the needs of their dependents*". Thus, Bartlett (2008:502) argues that there is a need to understand that "*events that might have little or no*

*effect on children in high income countries and communities can have critical implications for children in poverty*". This is important for flooding in developing countries. Thrush et al. (2005) highlight that children are a sub-group that is vulnerable to flooding. In addition to this, some researchers highlight the need to understand children's perspective of flooding (Tapsell, 1997; Tapsell et al. 2001; Waddell, 2010). The fact that children are neglected in the research that recognizes the role of children as social actors in their own right becomes problematic especially when there is need for resilience as a strategy of coping with future floods (Waddell, 2010). This will be crucial in helping to build resilience, as children are not only community members in their own right, but also citizens of the future (QCA, 2008). It is unfortunate that the issue of children and flooding is under-researched, especially research of flood recovery, floods and how children are vulnerable to them. But, there is a growing body of literature that highlights that children should be recognized as a sub-group that is particularly vulnerable to flooding (Thrush et al. 2005).

Floods cause health risks through exposure of children to pathogens, contaminated water, food, sewage, mould, contaminated household items and dead animals. The sources of such exposures have been recorded in schools, homes and playing areas (Gibbons et al. 2005).

The work of Valentine (1997) highlights that recent research done on the geographies of children shows how adults have little knowledge of the children's social worlds. Children are therefore not well represented in most research on flooding (Blaikie et al. 1994; Wisner, 2003).

In part, the UNICEF (2012) report documents that the health of children can be better understood through understanding the socio-economic status in which they are born and brought up. Such conditions are successively moulded by the way resources and powers are distributed.

In addition, a study by Bunyavanich et al. (2003) indicates that children are more vulnerable to flooding because children often consume more water per day as compared to adults. Therefore, greater consumption of water results in greater exposure to waterborne pathogens, especially since children's immune systems are less effective in fighting pathogens. This makes children more susceptible to illnesses caused by floods (Bunyavanich et al. 2003).

Flood resultant health risks include infectious diseases and non-infectious diseases. These are easily contracted due to poor sanitation facilities, poor water quality and lower water usage,

lower levels of domestic hygiene and a lack of waste collection disposal (Bartlett 2008). Work by Ciottone (2006) highlights that defecation occurs randomly throughout settled areas, and mothers throw diapers of their young children anywhere because of lack of proper solid waste dump sites enabling the propagation of fecal pathogens. Whilst these are a daily hazard, constant floods and normal rainfall effects exacerbate them.

Other flood-related physical health problems affecting children include eczema, colds, coughs and psychological problems (Tapsell and Tunstall, 2001; Watson et al. 2007). Scholars like Flynn and Nelson (1998); Sverdlik, (2011) argue that children are physiologically vulnerable to flooding as a result of playing in hazardous conditions. Little boys and girls normally play outdoors with stagnant water, rusty iron sheets and dirty bottles, which pose a serious risk to their health.

Some scholars argue that natural disasters like floods are also capable of affecting the mental health of children severely - emotionally, physically, intellectually and in terms of behavioral disabilities (Flynn and Nelson, 1998; Khuwaja, 2010; Sverdlik, 2011; Tapsell et al. 2002). Unfortunately, "*impacts of children may not be fully apparent because they might hide their emotions, (particularly when they can see that their parents are upset), or parents may be too pre-occupied with crisis management to really consider how children are affected"* (Hulme et al. 2002:12). The aforementioned is supported by studies that indicate how the development of children can be affected by the effects of flooding particularly on the social and physical aspects of their lives (Delap, 2000; Zoleta-Nantes, 2002).



2.5.3.2. Resultant illnesses

The list of illnesses below highlights a few of the flood related illnesses that mainly affect children following a flood.

*Respiratory diseases*

Exposure to mould and dampness as a result of flooding has an effect on people's health, but with more repercussions on children's health (Dales et al. 1991). Studies have highlighted the prevalence of respiratory symptoms in children in homes where dampness and mould were identified (Fewtrell and Kay, 2006; Tapsell et al., 2006). Growth of mould inside the dwelling

has an impact on health through ingestion and/or direct respiratory infection (Alderman et al., 2012). The health impacts were identified as cough, chest infections, colds, fevers, asthma, sore throat, flu and worsening of asthma among most children in informal settlements (Barnes and Mathee, 2000; DiMP, 2005; Ligon, 2006). In a study done by Benjamin (2008) on flood risk assessment in Thembalethu, George, which compared Reconstruction and Development Programme (RDP) houses and informal settlements, it was found that children in informal settlements experienced a larger number of respiratory illnesses as compared to children of RDP houses. The infections included pneumonia, asthma attacks, sinus, whooping cough and colds.

*Gastrointestinal infections*

Waterborne infections have been reported to increase gastrointestinal diseases, such as diarrhoea and upset stomachs (Benjamin, 2005; Bility and Onya, 2000; Chinyenze-Daniel, 1999; Tapsell et al. 2002). A number of studies indicate that gastrointestinal infections are contracted mainly by young children, because during their play time they drink contaminated water or put their dirty hands in their mouths after playing with contaminated flood waters (Bunyavanich et al., 2003; Fewtrell and Kay, 2006; Jakubicka et al., 2010). A study by Alderman et al. (2012) indicates that high rates of gastrointestinal illnesses are not entirely due to the behavioral patterns of children, but could also be a result of poor hygiene by the household. Other authors argue that some of the gastrointestinal infections are a result of contamination of drinking water sources (Few and Matthies, 2006, Few et al. 2004; Minamiguchi, Undated; WHO Flooding and communicable diseases fact sheet).

*Earache and skin rash*

Besides the increase in gastrointestinal infections, illnesses like skin rashes and earache have been found to be common post-flood illnesses (Benjamin, 2005; Bility and Onya, 2000; Fewtrell and Kay, 2006; Reacher et al., 2004). In a study by Alderman et al. (2012) in Thailand following the 2005 floods, 59 patients out of 102 patients suffered from inflammatory dermathoses and 40 were diagnosed with infectious skin conditions.

*Vector-borne illnesses*

Floods are well known for increasing the spread of vector-borne illnesses, which include yellow fever, West Nile fever and malaria. These illnesses are spread to humans through insect bites. Floods increase the exposure of people, especially children, to vector-borne diseases, because it provides breeding places for the vectors (Ahern et al. 2005; Alderman et al. 2012; Few and Matthies 2006; WHO, Flooding and communicable diseases fact sheet)

## 2.6. SUMMARY

The chapter explored three domains of literature, flooding and informal settlements and children's illnesses that are associated with flooding. The perspectives that led to child vulnerability and the most common types of illnesses were explored.

The chapter described the views on informal settlements and how flooding affects children's health in informal settlements. The reviewed literature also indicates the paucity of literature that links flooding to child health in informal settlements.

# CHAPTER 3: RESEARCH CONTEXT

## 3.1. INTRODUCTION

The study's primary data collection was conducted in an informal settlement called Barcelona, located in Cape Town, South Africa. This chapter gives an overview of the city of Cape Town as a whole, followed by brief descriptions of the location of Barcelona, the types of dwellings and the microclimate and ecology of the settlement.

## 3.2. OVERVIEW OF THE CITY OF CAPE TOWN

Cape Town, which had an estimated population of between 3.6 and 3.8 million people in 2011 (Western Cape Provincial Treasury, 2011), is one of the most inequitable cities in the world (UN-Habitat, 2010a). About 40% of households are classified as poor, in other words, with insufficient income to access basic necessities such as food and shelter (City of Cape Town, 2011). In addition, as with other South African cities, Cape Town has an inefficient, fragmented spatial structure that preserves racial inequalities inherited from the apartheid period, and post-apartheid spatial changes are exacerbating this fragmentation and segregation (Lemanski, 2007; McDonald, 2008; Turok, 2001; Wilkinson, 2000).

Authors like Olorunfemi (2011) have highlighted that Cape Town is a city of contrast. "*Wealthy , lush suburbs nestle around the mountains surrounding the city bowl, while the majority of the city's poorer residents live in the Cape Flats, an inhospitable, spatially and topographically disadvantaged plain on the eastern outskirts of the city…"* (Olorunfemi, 2011:16). While Smit (2006) highlights that the issues of development disparities are embedded in both continued peripheralization and poor apartheid planning. During apartheid, poor people were forced to live in socially excluded townships such as the Cape Flats, with restricted access to facilities and services, and most informal settlements continue to be located on the margins of, and spaces between, these townships (Holloway and Roomaney 2008; Huchzermeyer and Karam, 2007; Olorunfemi, 2011).

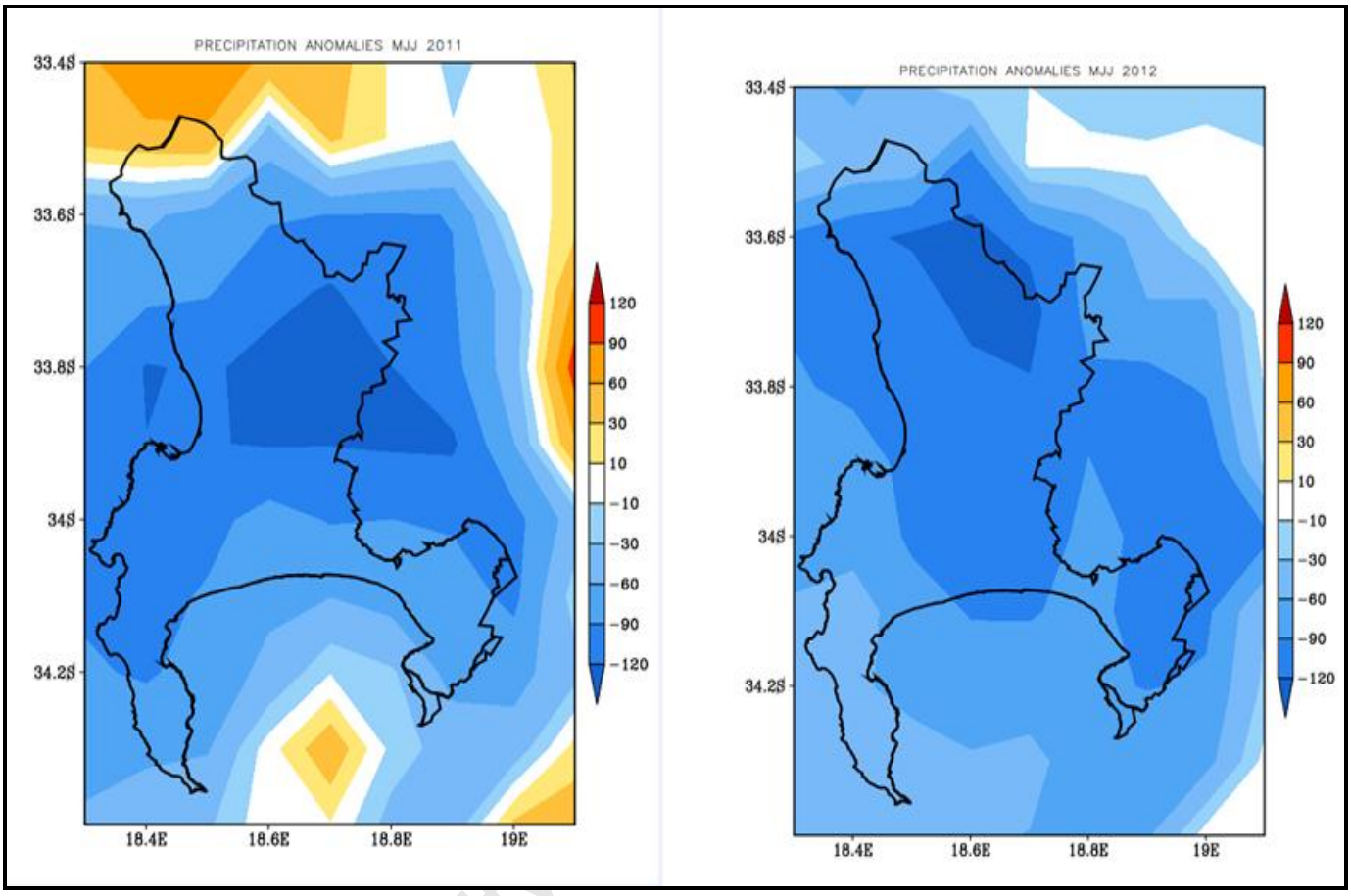
Like other African cities, urbanization has exerted enormous pressure on the city's ability to provide infrastructure, housing, services and employment to its growing population (Huchzermeyer and Karam, 2007; Olorunfemi, 2011). It was estimated that in the year 1993

there were approximately 23 000 families living in informal settlements in Cape Town and the numbers have been increasing, with an estimated 109 000 families reported to be living in informal settlements in Cape Town in 2007 (Olorunfemi, 2011).

### 3.2.1. Flooding in Cape Town informal settlements

Cape Town experiences heavy rainfalls annually during winter, and is well known for its wet winters (Holloway et al. 2010; Holloway and Roomaney, 2008; Olorunfemi, 2011). Cape Town has been identified as a city that is vulnerable to climate change and its impacts (Ziervogel and Smit, 2009), through the use of projections obtained from the Climate Systems Analysis Group (CSAG). Figure 4 below, depicts plots of rainfall anomalies for the May-June-July (MJJ) period (for 2011 AND 2012 seasons). The data are from the US National Centers for Climate Prediction (NCEP). Anomalies are calculated as a difference between each season (2011 and 2012) and the respective May-June-July mean. Generally, positive anomalies portray more rainfall in that particular season while negative anomalies represent less rainfall. In the maps, blue color was used for negative anomalies whereas the red color was applied for the positive anomalies. In both plots, negative anomalies are more predominant, which means that it rained less than normal in the two seasons but it does not necessarily mean that the floods did not occur. Furthermore, in some locations the negative anomalies are less than 10 millimeters. These anomalies indicate that there were no floods, as officially defined, that were recorded in Cape Town. Such anomalies indicate that official statistics have a very narrow definition of flooding that does not capture numerous events experienced by residents as flooding. This is proven by the fact that during the time the statistics indicated that there was no flooding in Cape Town, dwellers of informal settlements experienced numerous instances of flooding because of their poor types of dwellings and location in a high water table area.

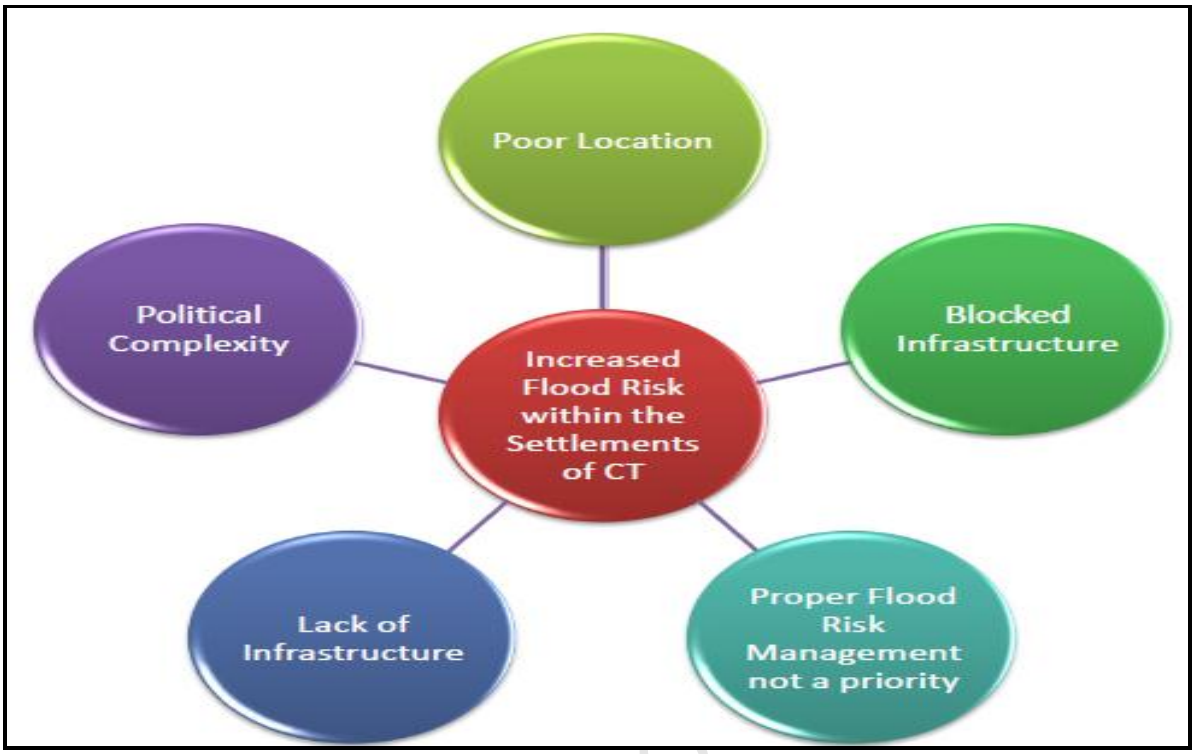
**Figure 4: Precipitation anomalies for May-June-July period (for 2011 and 2012 seasons**




Source: ftp://ftp.cpc.ncep.noaa.gov/fews/newalgo_est/).

Informal settlement dwellers of Cape Town experience rising flooding during winter as opposed to "flash flooding". As a result of the long periods of rainfall, the ground quickly gets saturated, thus leading to the collection of water especially in areas of poor drainage (Holloway and Roomaney, 2008). These waters are likely to cause health problems because the waters are exposed to waste and become polluted due to lack of adequate solid waste and sanitation management (Ziervogel and Smit, 2009). Most of Cape Town has extensive stormwater drainage infrastructure, but this does not apply to informal settlements (Bouchard et al. 2007). The issue of flooding in the city of Cape Town is not only attached to lack or insufficient proper stormwater drainage systems but rather a multitude of other issues. Work by Bouchard et al (2007) puts forward a number of reasons why flooding is multifaceted in the city of Cape Town (refer to Figure 5)

**Figure 5: Factors that increase flood risk in the informal settlements**




Despite the fact that there are inadequate drainage systems in the informal settlements, there are often surrounding drainage systems, including surfaced roadways, retention ponds and drainage ditches (Bouchard et al. 2007). Nevertheless, in numerous cases these services are rendered ineffective as a result of continuous blockages (Holloway and Roomaney, 2008).

The living conditions in most informal settlements are poor, thus playing a large part in exacerbating the peril of flooding (City of Cape Town, 2011). Most informal settlements in Cape Town are located on the Cape Flats, which is characterized by low elevation in relation to the neighboring mountainous terrain, thus they are obviously predisposed to the gradual accumulation of water (Bouchard et al. 2007). The ground quickly gets saturated thus leading to the collection of water, especially in areas of poor drainage (Holloway and Roomaney, 2008).

Owing to the fact that the dwellings in informal settlements are customarily fabricated from cheap material of corrugated iron sheets and wood, coupled to poor location in low-lying areas, makes it easy for flooding to damage the dwellings and their contents (Bouchard et al. 2007; Olorunfemi, 2011; Ziervogel and Smit, 2009). Moreover, the livelihood strategies of the informal dwellers can be affected too, especially when the floods affect the health of the

residents; this result in them having to stay off from work and having to spend money on fixing their dwellings (Holloway and Roomaney, 2008).

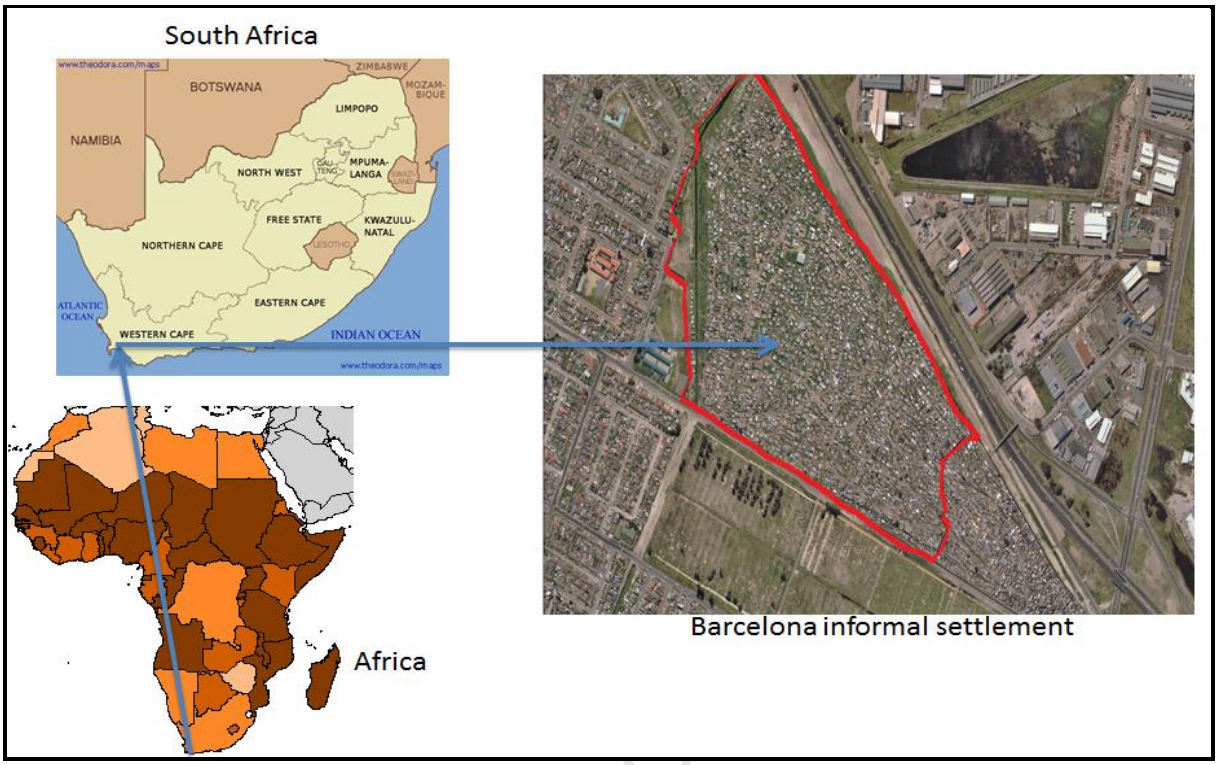
### 3.2.2. Health in the informal settlements of Cape Town

Winter floods of Cape Town are associated with a high risk of waterborne diseases, the high risk being a result of inadequate hygiene, and lack of basic services like proper waste drainage, potable water, and sewerage services and refuse collection from the respective government departments (Bouchard et al. 2007). Furthermore, the dwellings are densely populated, thus illnesses spread fast and easily (Bouchard et al. 2007).

## 3.3. BARCELONA

Barcelona is situated in the northern part of Gugulethu Township. Gugulethu is located in the South of the N2 highway which is about 17 kilometers east of the city Center of Cape Town and about a kilometer away from the Cape Town International airport (Dayaram et al. 2011). The settlement is located on the Old Nyanga refuse dump, erf 477. From 1956 to 1987 the area was used as a site for the disposal of industrial waste, builders' rubble and household waste (Dayaram et al. 2011). Figure 6 below shows the geographical location of Barcelona.

**Figure 6: Map showing the location of Barcelona**




The settlement was first established in 1992, primarily as a "temporary" settlement, and was named "Barcelona" after the Barcelona Olympics of 1992 (CORC, 2010; Hasler et al. 2011). From 2004 onwards, Barcelona experienced a large number of people migrating into the settlement, leading to the densification of the settlement. The ARG report highlights that most of the inhabitants of Barcelona are from the Eastern Cape. However, some of the inhabitants are from the surrounding settlements such as Langa, Khayelitsha, Gugulethu, Mfuleni and Mitchell's Plain.

### 3.3.1. Service provision

The informal settlement of Barcelona is poorly serviced because of geographical conditions and the obvious reason that it is an informal settlement. In 2010, approximately 6600 people lived in Barcelona, and at that time the settlement had 2200 recognized structures on 28 hectares of land, giving a density of approximately 78 households per hectare (CORC, 2009; Hilligan et al., undated). A survey conducted in 2010 indicated that there were 367 container toilets (waterless

latrines) and pit latrines in Barcelona that serviced the settlement (Hilligan et al. undated). The area is also serviced with poor roads (Dayaram et al, 2011).

The dwelling units of Barcelona consist of a variety of materials including corrugated iron, plywood and sheets of plastic, planks - the planks come in two different forms, as singles or already built walls. The average shack sizes for Barcelona is 18.6m$^2$ (Dayaram et al, 2011), the dwellings are usually in the form of small clusters (Hasler et al, 2011).

A report by CORC (2009) indicates that a large proportion of the population of Barcelona consists of young people. Less than 7 per cent of the settlement's population is above the age of 50 and approximately 40 per cent of the population is under the age of 35. A report by Dayaram and colleagues (2011) indicates that most crèches in the area are expensive. Therefore, most parents do not take their children to crèche, resulting in these children playing outdoors unattended, with dangerous items, and children often play in puddles. The community does not have specific play areas, so the children congregate in any open area between the houses.

### 3.3.2. Flooding

"*This area is a natural flood plain and has some naturally occurring wetlands*" (Dayaram et al, 2011: 11). The process of building houses and hardening of the surface has resulted in the destruction and the disturbance of a large number of the wetlands in the area. The N2 is one of the factors that leads to water ponding in the area, which further results in flooding (Dayaram et al. 20011). This results from the canal "*cutting through the northern edge*", where water is canalized. "*The canal acts as a drainage system to drain away some of the flood waters, but the canal also divides the natural hydrology (wetlands, flood plains) and prevents water seepage back into the underground aquifer"* (Dayaram et al, 2011:11). Furthermore, the canal is viewed as a major source of pollution. Dumped refuse, pollutants such as nitrates, phosphates, chloride and sulphites affect the quality of the canal water negatively, which can lead to child illnesses if the children get in contact with the contaminated waters.

Barcelona is located within a 1:50 year flood line, thus there is a high risk of flooding (Hasler et al, 2011). Flooding is common in Barcelona because of the annual winter rains and the fact that the settlement is located in a low-lying region of calcerous sandy soils and high water table,

hence resulting in flooding (ARG 2007, Hasler et al. 2011). During the winter rainfall period the water up-wells from the ground into houses "…*due to the high water table and the nature of the landfill site, when it rains there is nowhere for the water to go- it cannot soak into the ground due to the landfill"* (Dayaram et al, 2011: 5). However, the settlement is not serviced by a proper drainage system or a steep gradient that can help to drain the water away from the houses, hence the accumulation of water in low-lying areas (Dayaram et al, 2011).

In Barcelona, flooding is the most dominant type of disaster and this type of disaster affects approximately 82.2% of the residents (Dayaram et al, 2011). The type of flooding that is experienced in these areas is from rising flooding. Results from the enumeration that was conducted in Barcelona indicate that 60% of the population had their shacks flooded for about half a day or even longer during the winter rains.

### 3.4. SUMMARY

This chapter aimed to provide a clear description of the research context. It provided an overview of the city of Cape Town, the nature of flooding in the informal settlements of Cape Town, health in the informal settlements of Cape Town. Lastly particular focus was on the informal settlement of Barcelona, where the research was carried.

# CHAPTER 4: METHODOLOGY

## 4.1. INTRODUCTION

This section outlines the study methodology, with the research focusing on two winter periods (2011-2012) of Cape Town. A mixed research methodology was applied to test the research question, integrating both qualitative and quantitative research methodologies. The quantitative methodology entailed a questionnaire survey and the qualitative methodology entailed administering of focus group interviews (. The chapter is divided into six segments, which are: (i) participant selection, (ii) research instruments, (iii) collection of data and (iv) researcher positionality (v) data analysis and (vi) analytical framework.

Some scholars have advocated the use of one type of methodology. Their argument is mainly pragmatic, because there is the need to consider the study's scope and time restrictions of the study. Amaratunga et al. (2002) disagree with this, suggesting that the use of mixed research methodology is important because one methodology will compensate the weakness of the other methodology, thus there is a counter-balance. This means that the robustness of one methodology can be used to cover up the short falls of the other approach.

## 4.2. PARTICIPANT SELECTION

The research sample comprised 45 households with children, both boys (23) and girls (22) whose ages were in the 0-18. They were identified through the snowballing sampling method - this meant interviewing caregivers that were available during the time of the research, and then community members rendered assistance by introducing the researcher to other households.

## 4.3. RESEARCH INSTRUMENTS

Primary data research instruments that were used in the research were two focus group discussions, a questionnaire survey and site observations (refer to appendices 1 and 2). A pilot test was conducted before the main collection of data in order to test the research methods, so that the research instruments could be modified or clarified where necessary.

### 4.3.1. Questionnaire

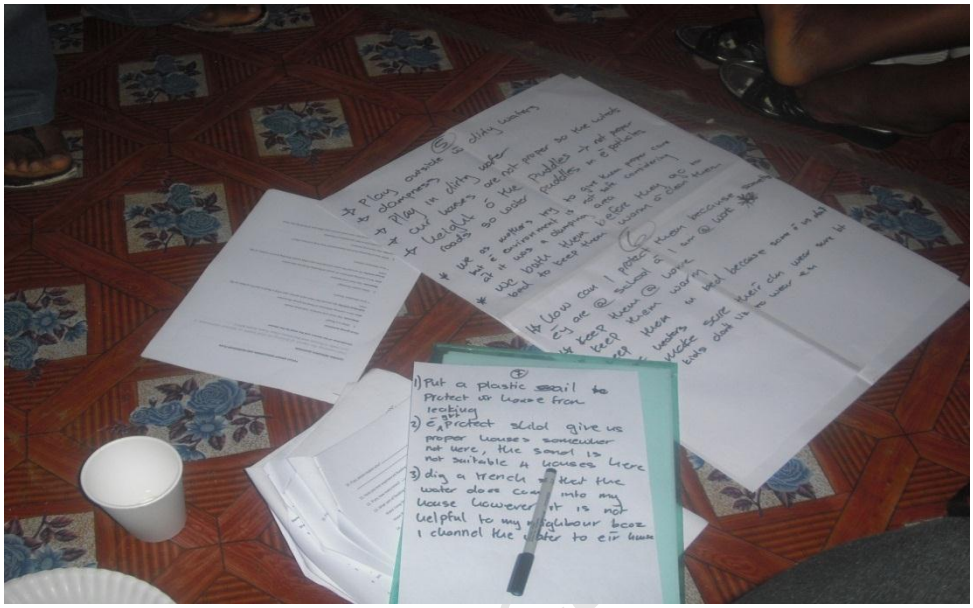
The instruments were constructed by generating items from the reviewed literature. Generated questions included flood-related childhood illnesses and socio-demographic information, in the format of a questionnaire using binary questions and semi-structured questions. The questions were further examined in order to eliminate unnecessary wording, and ambiguity. The questionnaire took approximately 30 minutes to complete. A pilot test of the questionnaire was tested in 12 households in Barcelona, using the convenience sampling method. Convenience sampling is a nonprobability sampling methodology in which people are sampled because they are available. This was done in the presence of a translator.

### 4.3.2. Focus group discussions

Two focus group discussions were conducted in order to have an in-depth understanding of the caregivers' perceptions of flood-related childhood illnesses. The central question of the focus group discussions was generated from the research question and the reviewed literature. The central research question was "Understanding the impact of flooding on child health in informal settlements: A case study of Barcelona, Cape Town, South Africa." The questions that were applied during the focus groups were open-ended questions. There were two people who conducted the focus groups; these were the moderator and the note taker. The focus group included eight respondents (six females and two males), who were managed by the researcher who was the moderator, especially when the discussion dissolved into other debates that were not flood-related. A positive atmosphere was cultivated before and during the focus group discussions; this paved the way for a rich discussion. This was done through the building of good rapport with the participants by both the moderator and the note taker. Behavioral techniques that were used by both the moderator and the note taker in order to create a relaxed environment for the participants included being friendly, smiling, speaking in a calm tone and making eye contact. Most importantly, the moderator and the note taker used humour, which lightened the atmosphere. In addition, the researcher made sure that all the group members participated in the discussion (Babbie and Mouton, 2007; David and Sutton, 2004). This was achieved by directly asking the quiet members to contribute and assuring them that their opinions were valued. A

checklist was used in order not to neglect vital information. The focus group discussion was transcribed, and added to the data that were collected by the use of questionnaires.

**Picture 1: Focus group discussion notes**



**Picture 2: Participants of the focus group discussions**

### 4.3.3. Site observations

The researcher conducted site observations on a transect walk of the settlement, using a checklist. The point of the transect walk was for the researcher to observe the surroundings of the community in order to acquire a broader understanding of the geographical features of the settlement. This enabled the researcher to examine the types of houses, children playing and their playing areas, and the conditions that lead to child illnesses in the settlement, especially during and after flooding (Holloway and Roomaney, 2008). During site observations, photographs were taken with the permission of the respondents.

## 4.4. DATA COLLECTION

The collection of the primary data took place from 21 April to 3 June 2012 (which was during the early part of the winter rainfall period). The research setting was "closed", meaning that for one to have access to the area one had to go through the gatekeepers. For this reason, the researcher was helped by one of the community members of Barcelona who works at the University of Cape Town. Once the researcher had gained access into the community, the researcher obtained an "overt" access to the field setting, which entails informing the participants about the research and getting their permission to carry on with the research. After gaining access into the community, the next day the researcher assembled all the materials that were going to be used in the field. The equipment included pencils, erasers, questionnaires, blank papers, markers and charts.

During the data collection the researcher resisted the urge of collecting everything that took place in the field. Thus, before the data collection resumed the researcher made sure that she had a clear research topic with clearly outlined research objectives. Nevertheless, it was of great importance to select the number of participants. It was decided that 45 children, both males and females, who suffered or had suffered from flood-related illnesses would be the required participants.

The other factor that the researcher had to put into consideration was that there were working caregivers, thus the research would be biased if it was only conducted in the mornings and afternoons of week days. In order to accommodate the working caregivers, some of the

questionnaires were conducted in the evenings and both focus group discussions were conducted during the weekends.

## 4.5. RESEARCHER'S POSITIONALITY

My research story is positive in part, but it is a story that made me question myself many times. It is of great importance for researchers to understand and to reflect on their position and how they negotiate their positions during field research. This section highlights the stress that the researcher grappled with during the fieldwork and how she tried to network with the caregivers. Work by Hopkins (2007) highlights that researchers should be able to recognize their positionality. Hopkins (2007: 387) further indicates that "*…various identities may influence and shape research encounters, processes and outcomes.*"

The first question that was posed to the researcher by every caregiver was "*Who are you?"* the researcher's identity was very important to the caregivers, maybe they wanted to know whom they were welcoming into their community and most of all into their private spaces (homes) and what sort of information they could share with the researcher. Every home that the researcher visited, the research assistant introduced himself, he made sure that he stated his first name, surname and lastly his clan name, which was also expected of the researcher. However, the researcher managed to give them her first and last name but could not provide the clan name because in Zimbabwe they do not have clan names. By failing to do so, the researcher realised that there was a difference between her and the caregivers.

Initially the researcher planned to research only women caregivers, because the researcher felt that women would know better about the well-being of their children as compared to their male counterparts. Nevertheless, this assumption was challenged when male caregivers indicated that they were also caregivers of their children, for the reasons that they were divorced or widowers. Thus, participation of male caregivers played a part in changing the original course of the research.

The researcher also tried to wear simple clothes and shoes that would match that of the community. This was done to avoid and lessen the effect of privileged identities, such as class, which can be placed upon the researcher by the participants (Bourke et al. 2009). Another issue that was observed by the researcher that had an effect on the research was the researcher's

educational background and nationality. The researcher's greatest barrier was her language - it created a space between *them* and *her*. These factors made the respondents speak in English even when they were told that it was fine for them to speak in Xhosa. They felt that what they wanted to say would be lost in translation; therefore they tried to speak in English.

Lastly, the researcher made sure she did not create false expectations that would lead people to believe that through the research their lives will change for the best. This rose from the questions that were being posed to the researcher by the respondents. "*… are you going to build playing areas for our children, I know you will help us, because our children walk bare feet in the dirty waters…".* The researcher dealt with this issue by not promising anything to the respondents, other than that she would give them feedback on the results of the research.

## 4.6. DATA CONSOLIDATION AND ANALYSIS

Quantitative and qualitative methodologies were employed for the collection and the analysis of data. The data were kept together, in two different files, one labeled quantitative data and the other labeled qualitative data. The analysis of the methodologies is explained separately below.

### 4.6.1. Quantitative

The analysis of the quantitative data included assigning a number to the questionnaire from 1-45. Each question was then captured in an Excel spreadsheet. After capturing all the data in an Excel spreadsheet, simple descriptive statistical techniques were used. These included: percentages, averages, chi-square, ratios, graphs and tables. The aforementioned statistical techniques were used to explain and interpret any relationship between the variables and, in addition, interpret the research findings.

### 4.6.2. Qualitative

The analysis of the qualitative data consisted of transcribing the field observations and the focus group discussions, they were further put in different themes according to the research objectives. The analyzed information was used to corroborate or further explain the quantitative research findings. In the text of this thesis they are found in the form of direct quotes. Additionally, the themes were compared to the reviewed literature.

### 4.6.3. Analysis of both qualitative and quantitative data

Quantitative and qualitative data were analyzed through the use of a conceptual framework. The vulnerability framework of Turner et al. (2003) was applied for the analysis of qualitative and quantitative data.

## 4.7. ANALYTICAL FRAMEWORK

This section gives a brief insight into the conceptual framework of the thesis. To conceptualize the effects of flooding on child health, a vulnerability framework was used in order to explain the vulnerability of children and further understand the flood-related childhood illnesses that were found in Barcelona.

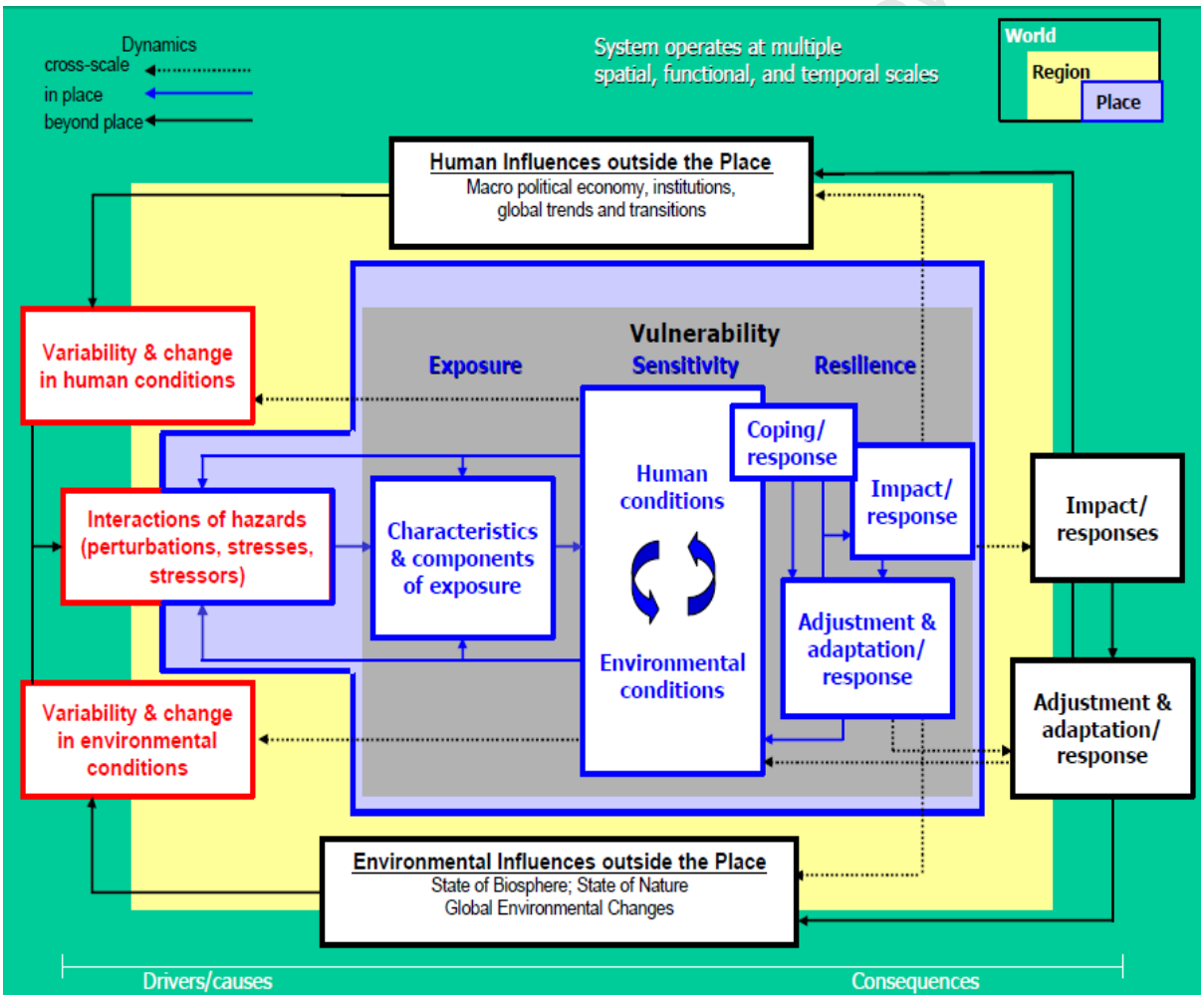
Vulnerability measurement has recently been viewed as an effective way of understanding risk and additionally as an effective basis for building disaster resilience (Birkmann, 2006). Bohle (2002) persuasively argues that vulnerability is multifaceted in nature, thus arguing that the term vulnerability stands in need for further explanation. Birkmann (2006: 11) eloquently pleads that "*we are still dealing with a paradox: we aim to measure vulnerability, yet we cannot define it precisely."*

### 4.7.1. Vulnerability framework disciplines

The anchorage of vulnerability is shaped by two research paradigms, which are the "human ecologist school" also known as the "Chicago school or Behavioral paradigm" and the "structural paradigm" (Hufschmidt, 2011; Pelling, 2003). The term "structural paradigm" is applied because "*it emphasizes the constraints which are placed on individual action by more powerful institutional forces*" (Hufschmidt, 2011:623). The vulnerability schools of thoughts have resulted in the development of various vulnerability assessment frameworks concerning environmental hazards. However, this thesis will apply the vulnerability framework that was developed by Turner et al. (2003), for the reasons that it is considered to reflect global environmental change and, in addition, it powerfully defines the term vulnerability in depth (Birkmann, 2006). Their vulnerability framework comprises three components, namely exposure, sensitivity and resilience. In addition, "*Vulnerability is viewed in the context of a joint or coupled human-environmental system*" (Turner et al. 2003: 8075). Thus, attention is directed

to questions such as "*who and what are vulnerable to multiple environmental and human changes underway and where? How are the human and environmental conditions amplifying these changes? And what mitigation measures can be put into place as a way of reducing vulnerability due to change? In addition, how communities can be resilient to such changes?*" (Turner et al. 2003: 8074). The vulnerability framework by Turner et al. (2003) characterizes coping response and impact response as distinct components of vulnerability, as shown in Figure 7. Interacting stress, stressors and confounding variations are put into perspective with this framework. Furthermore, the element of adaptation is included, significantly highlighted as a fundamental component that reinforces resilience (Birkmann, 2006).

**Figure 7: Full vulnerability framework by Turner et al. (2003)**

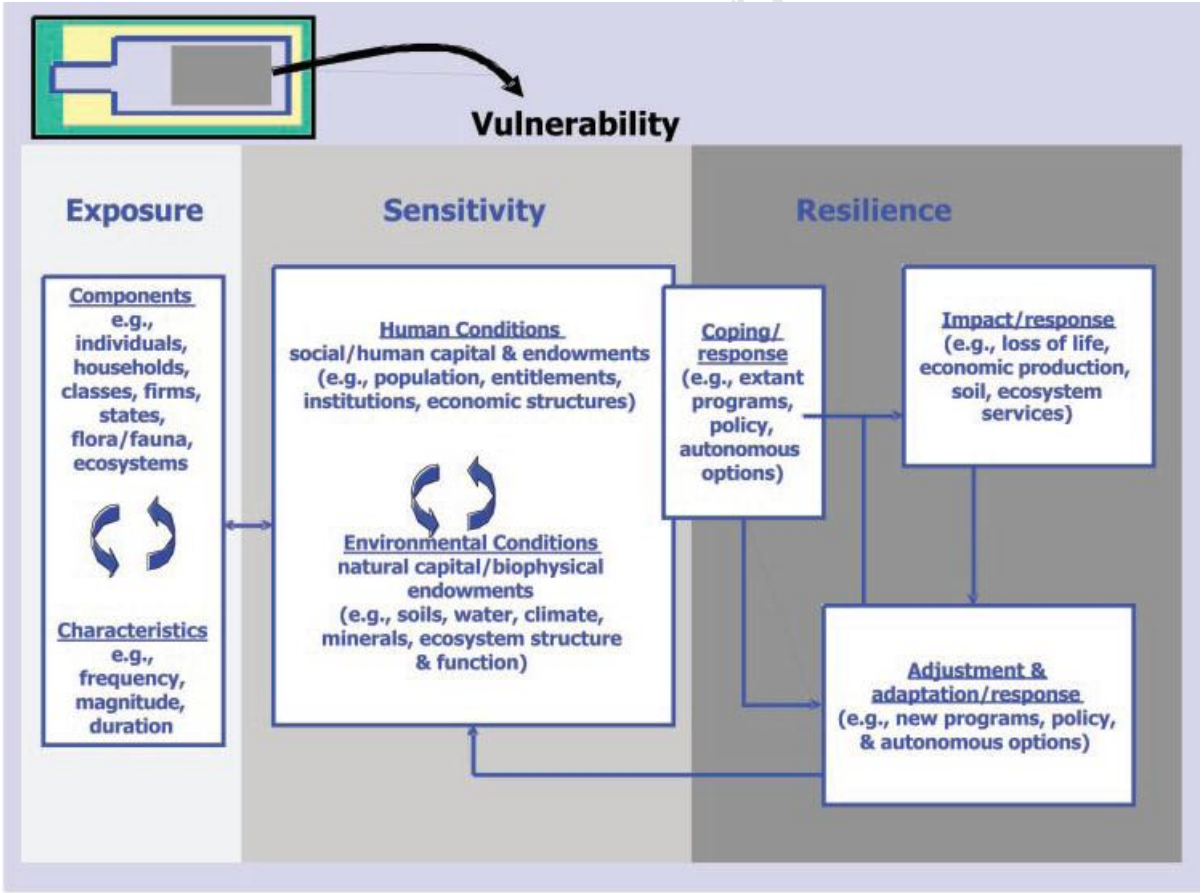


### 4.7.2. Vulnerability Framework components

The vulnerability framework highlights human vulnerability, resilience and the reciprocal relationship between "*macro-, meso- and micro- level human characteristics*" and how humans shape the experiences of urban environmental risks (Pelling, 2003:47). In examining vulnerability, it is important to integrate structure and agency, at the same time one has to acknowledge the importance of "*physical systems in generating hazard that can trigger disaster*" (Pelling, 2003: 47).

The vulnerability framework breaks down vulnerability into three components, which are E*xposure, Sensitivity/Susceptibility* and *Resilience* as shown in Figure 8 below. These components will be explained in detail below:

**Figure 8: The components of the vulnerability framework (Turner et al. 2003)**



**Exposure**: Its focus is on the physical location and characteristics of the surrounding natural and built environment. The risk of exposure can be reduced if individuals or households invest in hazard mitigation investments. In the case of floods, measures such as avoiding wetlands and having concrete floors can reduce the exposure component (Pelling, 2003).

**Sensitivity/Susceptibility**: This component focuses on physical, economic and psychological health and systems of maintenance of an individual, household or community. It further reflects on the capacity of a group of people or an individual's capacity to withstand the impact of a hazard (Pelling, 2003). "*The most successful efforts to enhance resistance will not directly target disaster vulnerability, but focus on wider goals of economic, social and political inclusion"* (Pelling, 2003:48).

**Resilience**: This is the ability of an individual or group of people to cope with or adapt to hazard stress. Resilience refers to those efforts that are undertaken to ensure robustness is built into the system before an event so that the system can bounce back after a hazard. (Pelling,2003). Resilience can be enhanced through the restoration, the preservation or the improvement of basic services and how they function. A key tool that is useful is "*spreading the economic costs of disasters across society and over time is insurance*" (Pelling, 2003:48).

The individual or collective access to resources, rights and assets can shape these three components of vulnerability (Blaikie et al. 1994).



## 4.8. SUMMARY

This chapter describes the research methodology of this study, and highlights the process of data collection and data analysis of the research. The section describes the procedure used to to prepare the research tools. The chapter also gives the positionality of the researcher in the field. The chapter makes clear the process that was used to consolidate the data and how the data were analyzed. Finally, it introduces the conceptual framework for the study, and components of the vulnerability framework, are discussed.

# CHAPTER 5: FINDINGS AND ANALYSIS

## 5.1. INTRODUCTION

This chapter presents the research findings from the questionnaires, focus group discussions and observations of the study. The analysis presented in this chapter helps in understanding the type of childhood illnesses that resulted from flooding in Barcelona in the month preceding the survey. This was achieved through examining the association between housing in the informal settlement of Barcelona (for example, type of dwellings in the settlement, such as type of floor, roofing, and location of house) and its potential to withstand repeated flooding. Secondly, this section analyzes the conditions of the dwellings and the surrounding environment that lead to childhood illnesses and lastly, seeks to understand the incidence or occurrence of flood related illnesses among the children in Barcelona.

## 5.2. DEMOGRAPHIC DATA

This section of the study presents the biographical information of the caregivers. The biographical and background information (socio-demographic variables) considered in this analysis include age, qualifications, sex, employment status, type of household, level of education, and number of years the caregivers lived in Barcelona. The biographical information of the caregivers and children was important in determining relevance of issues like vulnerability (*Exposure, Sensitivity/Susceptibility* and *Resilience*) of the children to the health impacts of flooding in any given area. The research findings are presented in text, tabular and graphical formats.

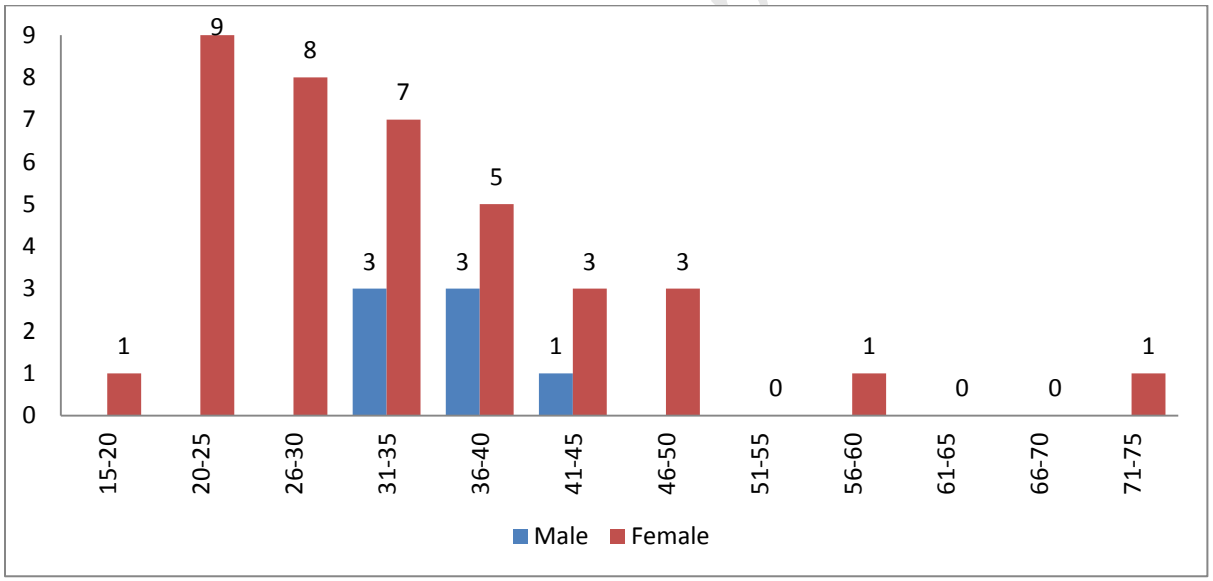
### 5.2.1. Caregivers

The types of caregivers that were found in Barcelona included biological fathers, biological mothers, grandmothers, aunts and uncles of the affected children. The majority (82%) of these caregivers were biological mothers of the children. There were relatively few male caregivers as compared to the female caregivers.

### 5.2.2. Ages of caregivers

Figure 9 below indicates the number of caregivers in relation to their age and sex. Figure 9 illustrates that majority of the caregivers were females (84%) as compared to male caregivers (16%). The probable reason for this is that there are socially constructed gender roles in relation to childcare settings. The age range of the caregivers was between 18 and 73 years of age, with a mean age of 34. The caregivers were relatively young. Female caregiver's ages ranged from 18 years to 73 years, with the male caregivers' ages ranged from 31 to 45 years of age. For both sexes, the 20-25 age group had the largest number of caregivers. However, there was one female caregiver who was within the 71-75 age group - she provided for her daughter's two children. Such a case proves that the elderly are sometimes also burdened with caregiver duties, yet they also need to be taken care of.

**Figure 9: The age groups and gender of the caregivers**



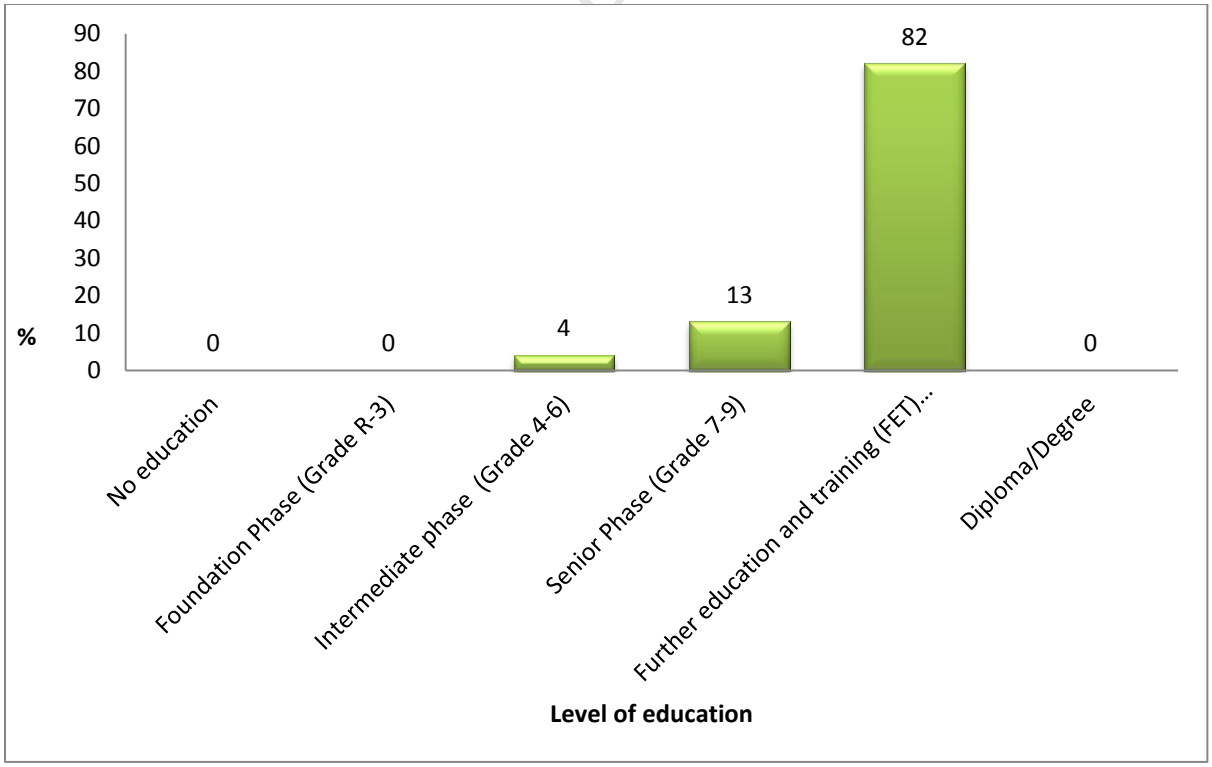

### 5.2.3. Literacy and educational levels of caregivers

Literacy and education levels are of high priority because they potentially allow better access to information on flooding, childhood illnesses and health-related issues by the caregivers. All the caregivers had some form of education. However, the researcher noted that 42% of the

respondents had noted their education in Standards. These were converted to Grades using the South African Qualifications Authority (SAQA). From the analysis, the levels of education in Barcelona varied from Grade 6 (Intermediate phase) to Grade 12 (Further Education and Training phase). Figure 10 shows that all the caregivers managed to complete the Foundation phase (Grades R-3) of their education, while 4% of the caregivers indicated that they managed to reach the Intermediate phase (Grades 4-6). About 13% of the respondents reached the senior phase (Grade 7-9) of their education but could not continue to Further Education and Training (Matriculation level/ National Senior Certificate). There were a significant number of caregivers (82%) who pursued their education to Further Education and Training (Matriculation level/National Senior Certificate). Enrolment into universities after Matriculation lags behind in Barcelona; this is illustrated by the lack of numbers of caregivers who possess a diploma or a degree. Moreover, English literacy was very low among the caregivers; this was indicated by their inability to read and fill out the questionnaire and they were unable to speak to the researcher in English. Most of the caregivers who were working were employed in low paying jobs because of their inability to write, speak and read English.



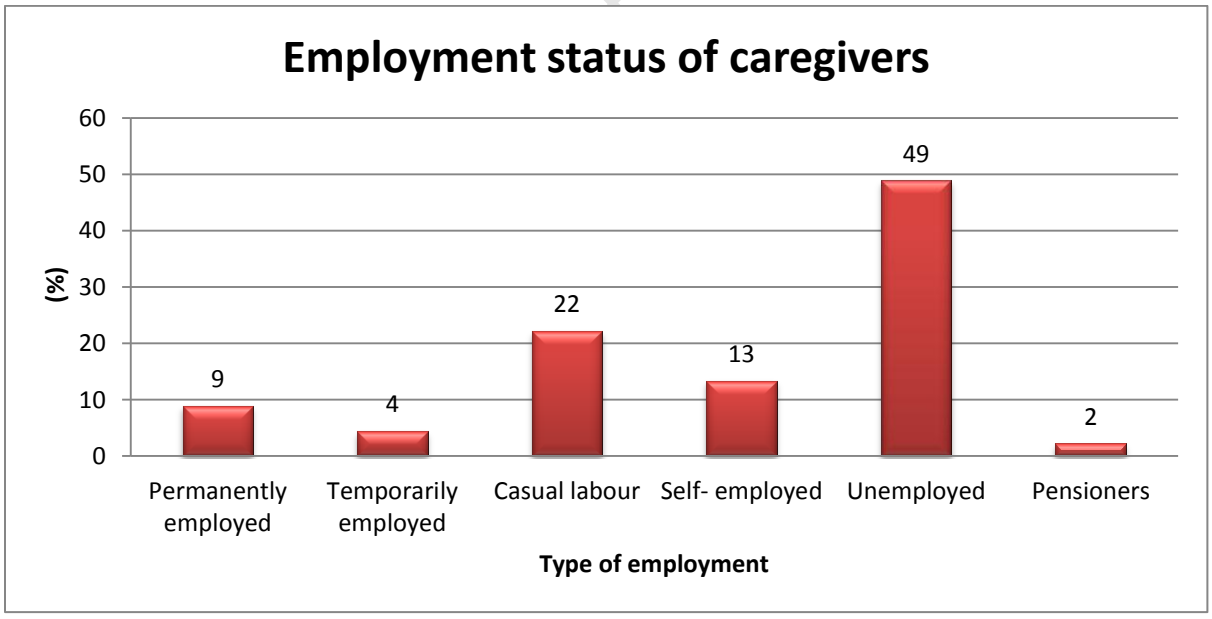
**Figure 10: Highest levels of formal education completed by the caregivers**



The study also investigated the livelihood strategies and employment status of the caregivers because such factors play an important role in one's access to resources and better opportunities. Figure 11 [1]gives a clear difference in the livelihood strategies and employment levels of the caregivers in Barcelona, with 49% of the caregivers reportedly unemployed at the time of the study. Significantly, on the one hand, over 22 % of the caregivers were casual workers (a daily working engagement which has no binding effect to ongoing employment). On the other hand 4% of the caregivers were temporarily employed, which meant that they had a contract with their employers (unlike someone who did casual work). 13% of the caregivers reported being self-employed, partaking in activities such as small-scale vendors (for example, selling chips) or braaing "smileys" (goat and sheep heads), intestines and pork. Notably, about 44% of the caregivers claimed to receive child support grants from the government, which denotes that recipients are unemployed and dependent on Government grants. Lastly, 2% of the respondents were pensioners. From the data presented in Figure 11, one can see that there were also high levels of unemployment (49%).



**Figure 11: Employment status of the caregivers**




[11] Some of the percentages for the Figures do not add up to 100% because of rounding off.

### 5.2.4. Types of households

The stability of the household and type of household play an important role in this research, because there are benefits that are associated with being a stable household versus an unstable household. Generally, the more stable the household the better it can access medical advice when their children suffer from flood-related illnesses. Notably, 29% of the caregivers were never married, while 40% of the caregivers were either married or were co-habiting. A significant proportion of caregivers reported being divorced (18%) or widowed (13%). Interestingly, a relatively large proportion of households (35%) were headed by a single woman (see Figure 12). While 27% of households were nuclear families, there were a significant number of extended families, which can be divided into two types: the extended family with both husband and wife (13%), and the female-headed extended family (18%). Lastly, there were a small number of households headed by single men (7%).The households that mostly experienced the negative impacts of flooding were those that were female-headed (refer to Figure 13). Figure 13 illustrates the types of households in Barcelona. The series in Figure 13 indicates the five types of households and their percentages as proportions to the number of households that participated in the research. Nuclear families consisted of married couples with children (27%); single-male headed families included a father with children (7%); female-headed families consisted of a mother with children (35%) and, lastly, female headed- extended families were composed of a single woman and with her children and other persons that were related to the woman who was the head of the household (18%). An in-depth analysis revealed that single elderly women above the age of 45 and young never-married mothers below the age of 25 were particularly negatively impacted by flooding, owing to the fact that their income base was small. Research findings indicated that women's opportunities for employment and education were limited as a result of early marriages in women below the age of 25.

Hence, the gender of the head of the household had an impact on determining the households most at risk of flooding.

**Figure 12: Marital status of caregivers in Barcelona**

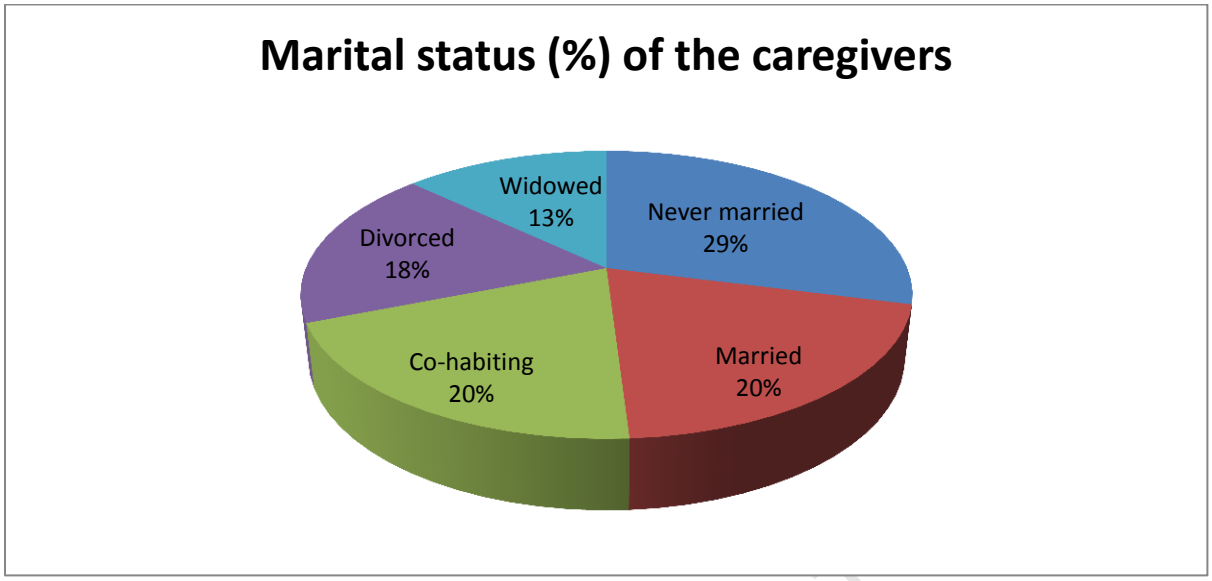
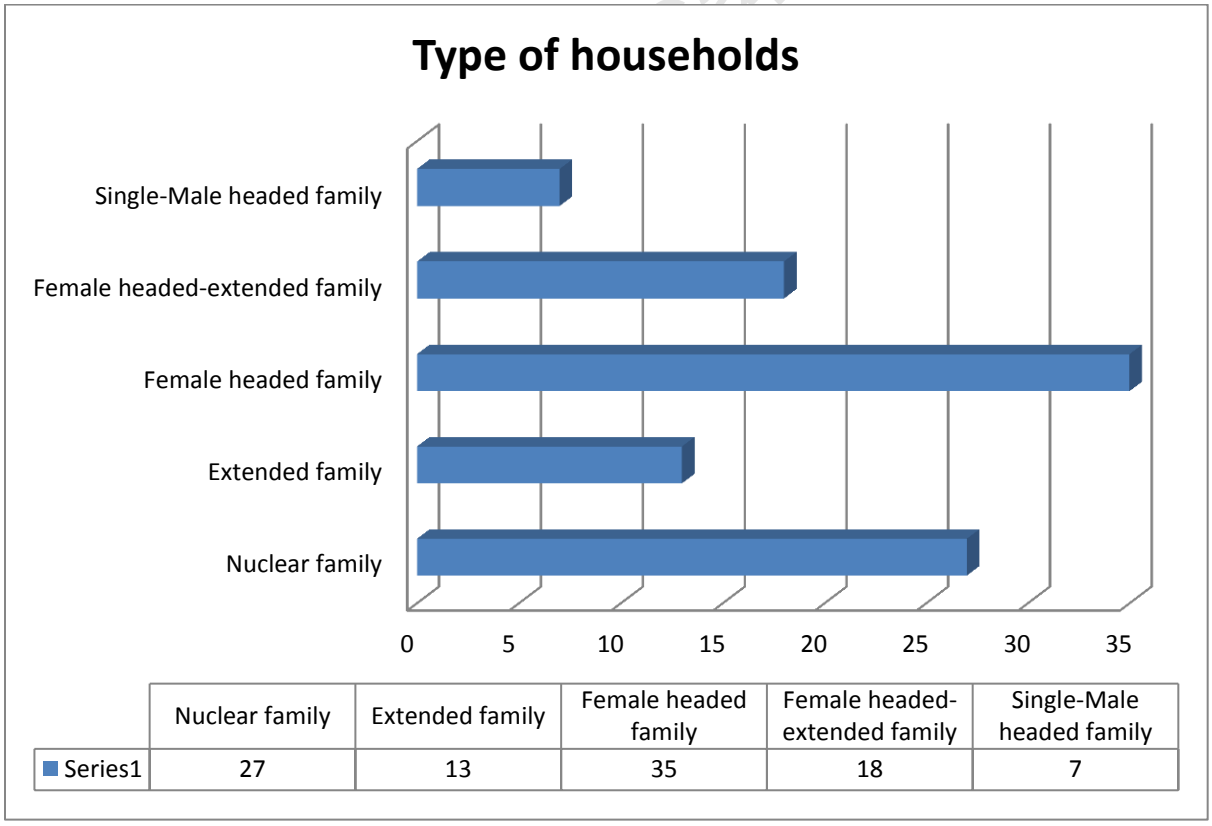


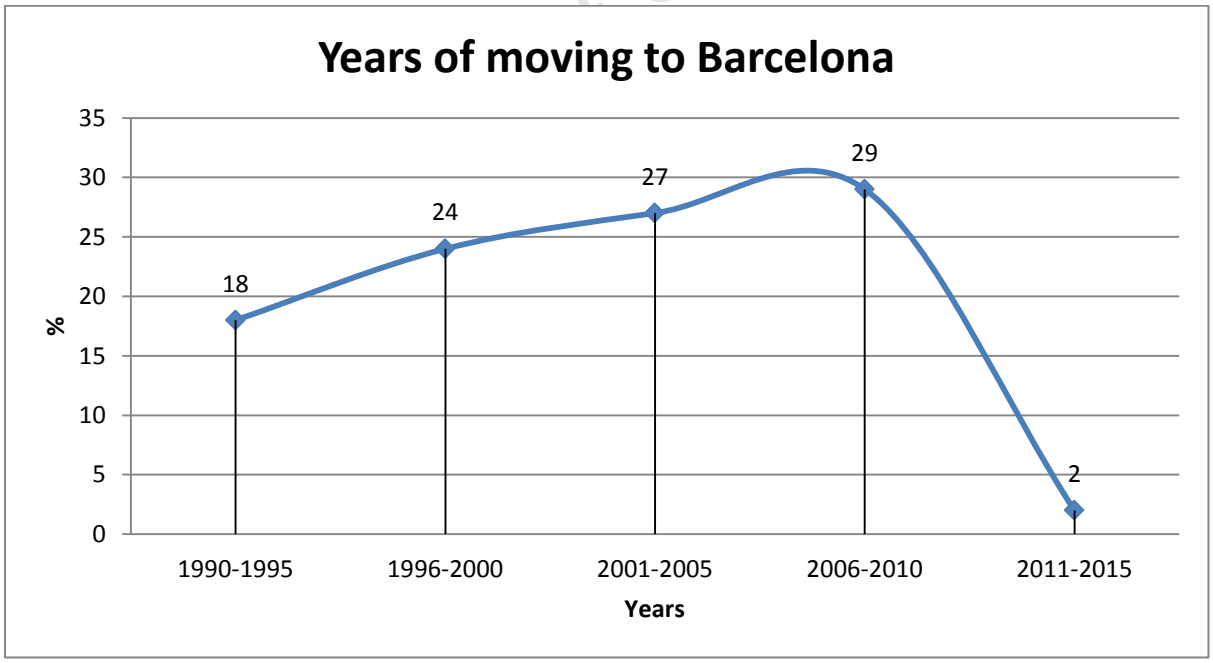

**Figure 13: Type of households in Barcelona**



### 5.2.5. Years of living in Barcelona

Analyzing the information regarding the duration of stay in Barcelona by all the respondents is important in understanding the social networks operating and indicates the amount of time that was available to the respondents to expand their knowledge and understanding of the impact of recurring floods and associated childhood illnesses. In this case, there were different durations of moving into Barcelona. The period of moving to Barcelona ranged from the year 1990 (before the settlement was recorded as being established) to the year 2012. Most of the respondents were relatively recent residents of the area (see Figure 14 below). Among the caregivers interviewed, 18% moved to Barcelona directly from the Eastern Cape, whereas 82% moved from other informal settlements in Cape Town. Information from the focus group discussions indicated that there was no positive relation between the number of years resided in Barcelona and the ability of the caregivers to cope with the floods. Children of the early settlers and of the late settlers of Barcelona suffered from the same illnesses.

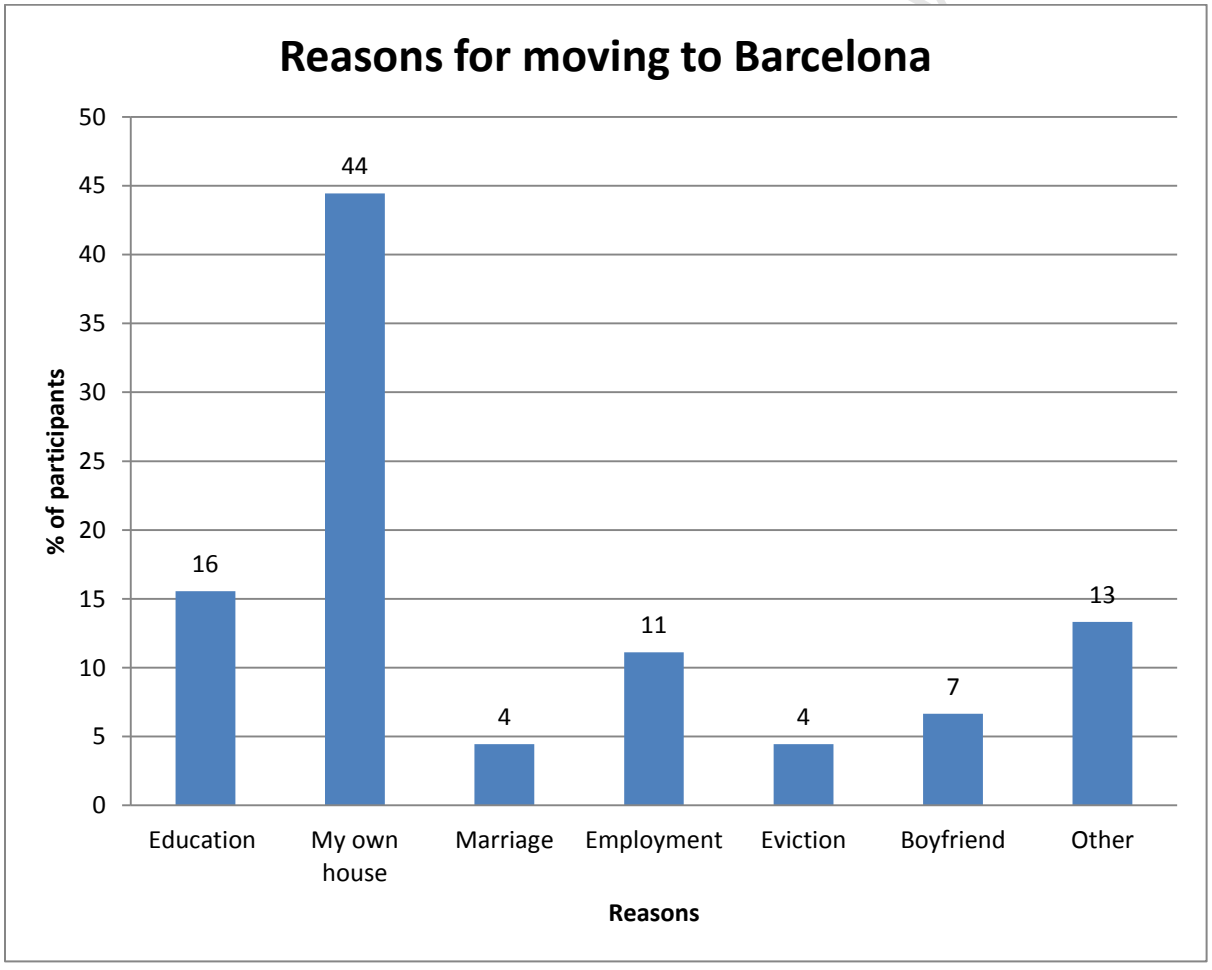
**Figure 14: The years which the caregivers relocated to Barcelona**



### 5.2.6. Reasons for moving to Barcelona

The reasons for moving to an informal settlement are important factors that might provide answers as to why individuals build their dwelling in a certain area. A significant number (45%) of the respondents stated that owning a house was the main reason for moving to Barcelona. A small proportion of the respondents (16%) claimed to have moved to Barcelona for educational purposes, indicating that formal education was the second largest pull factor to Barcelona. However, a handful of respondents moved to Barcelona because they had been evicted from their place of origin (4%) or because they got married to someone living in Barcelona (4%).

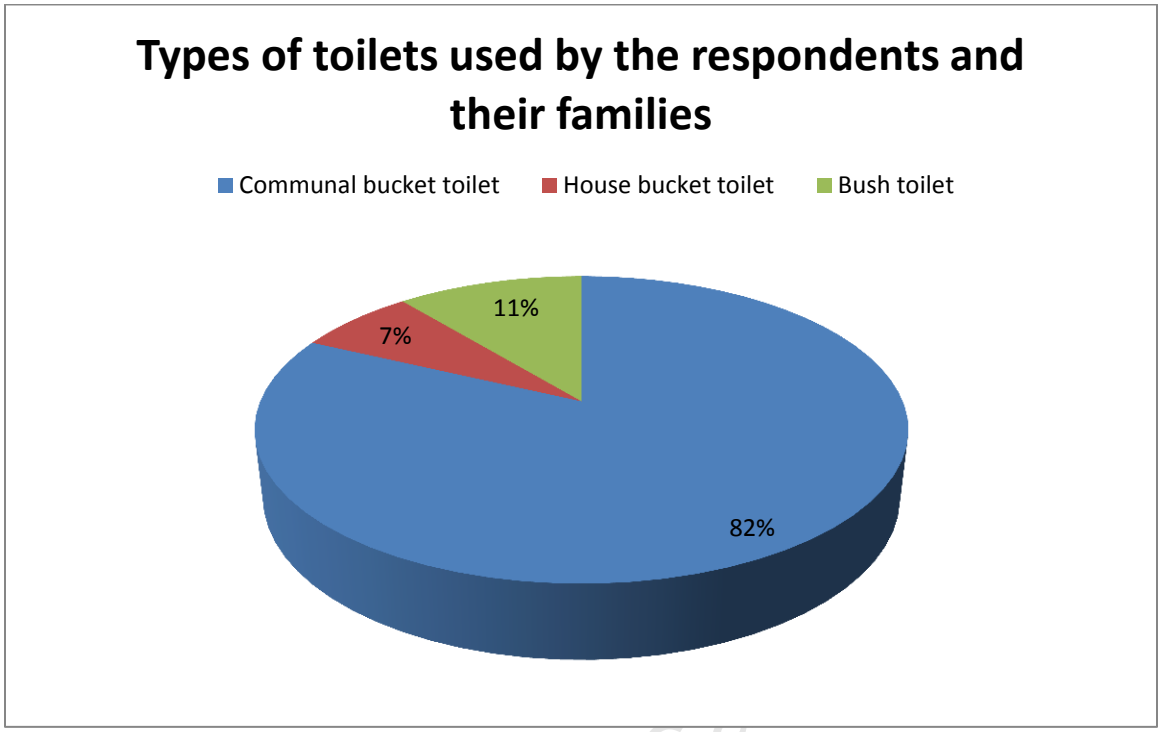
**Figure 15: Reasons for moving to Barcelona**



### 5.2.7. Access to basic services

*"Where we live matters",* a quote extracted from ***State of the world's cities 2006/7*** (UN-Habitat, 2006), highlights the correlation between one's well-being and basic services such as formal houses, proper water and sanitation, education and health facilities. During the time of the study it was observed that all the respondents lacked proper houses, their houses were poorly constructed, and they lacked proper sanitation. 7% of households had household bucket toilets (these toilets were not part of the toilets that were provided by the City of Cape Town, but were provided by households themselves for their own use) and 11% of households said they had no access to toilets ("bush toilets", as the respondents called it), as some households locked the communal toilets or changed the padlocks without informing the other households, or else they regarded them to be too far from their dwellings (refer to Figure 16). During the time of the research there was an average of one toilet per 6 families, but approximately 57% of the toilets were blocked or not fully functioning. All the dwellings had access to running water (communal taps). However, some households were located further away from the communal taps. Another major issue in Barcelona was that of waste removal, on average the waste was removed once a week from the communal skips, unlike better-serviced areas where waste from communal skips is reportedly collected two or three times a week.

**Figure 16: Types of toilets used by households in Barcelona**




### 5.2.8. Summary of the socio-demographic factors

In summary, there were more female caregivers as compared to the male caregivers. Most of the caregivers were in the 20-25 age groups, making them a relatively young age group. There were relatively high levels of literacy and education (completion of Matriculation) for most of the caregivers, accompanied with high levels of unemployment. Nevertheless, no one had managed to acquire a diploma or degree. The findings indicated that family units of Barcelona were generally not stable, with high rates of single parents. Lastly, there were low levels of service delivery in the settlement.

## 5.3. FACTORS INFLUENCING FLOOD VULNERABILITY IN CHILDREN

This section of the study presents flooding as a hazard to the household. The information was gathered through, examining the affected dwellings, understanding the caregivers' knowledge of flooding risk, height of flooding and duration of flooding.

### 5.3.1. Affected dwellings

Most of the dwellings (93%) were affected by flooding, for the simple reason that: (i) the dwellings were located in areas of poor drainage; (ii) the houses were poorly built, thus they could not withstand harsh weather conditions, including heavy rains; (iii) the settlement is located in an area with a high water table. The remaining caregivers (7%) did not experience flooding.

### 5.3.2. Knowledge of flooding risk

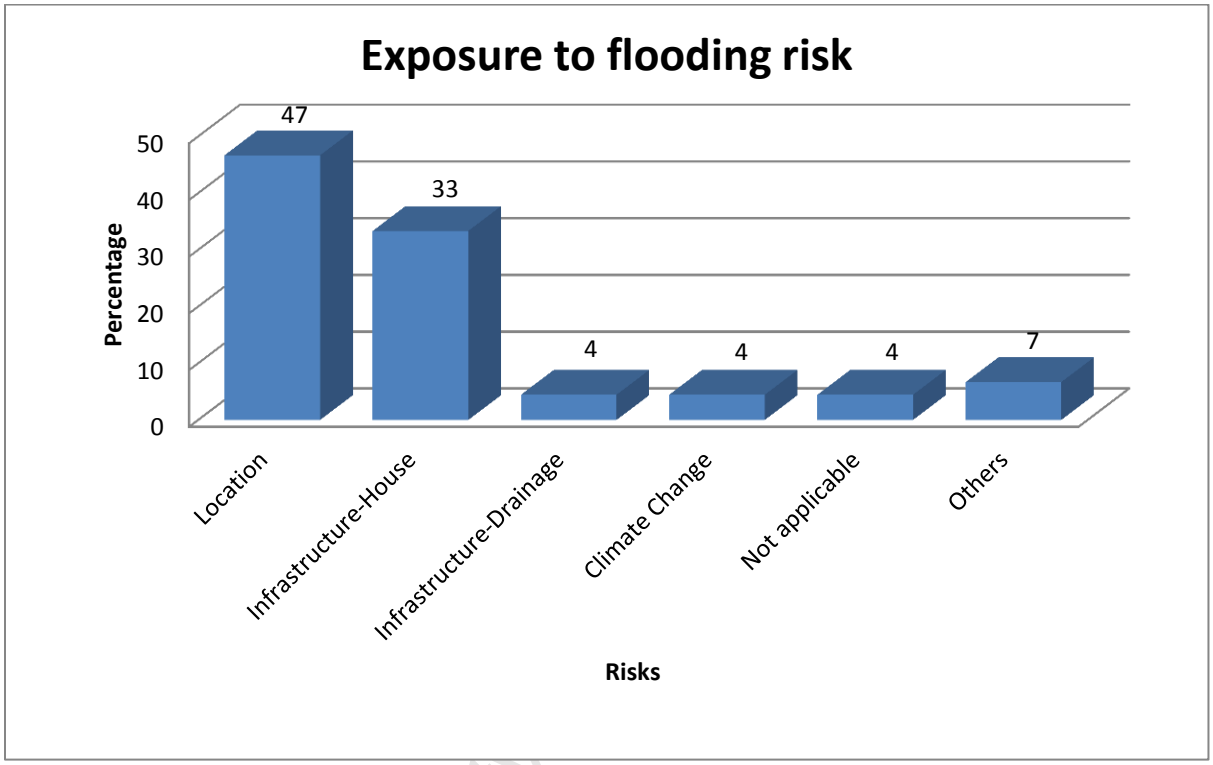
It is important that the caregivers have enough information regarding flood risks and the impacts of flooding in order to enable them to protect their children from flood-related illnesses. The study therefore explored whether the caregivers were well equipped with relevant information applicable to protecting the lives of their children. Research findings from the focus group discussions demonstrated that the majority of the caregivers were aware of negative health impacts that were accompanied by flooding. Focus group participants informed the researcher that they had basic knowledge of flood-related health impacts, but would appreciate more information on flood-related health impacts, considering that flooding was generally an annual event. A significant number of caregivers (60%) relied on media (news and weather reports) for weather forecasts, with the remaining 40% saying they received no warnings concerning flooding. All the caregivers indicated that government, non-governmental organizations and community based organizations did not disseminate any information or warnings with regards to flooding.



The researcher proceeded to examine and explore the caregivers' perceptions on knowledge of exposure to flooding factors. The maxim "***knowledge is power***" suggests that if one is knowledgeable, one is able to make wise and sustainable decisions. For this reason, it was of great relevance to understand what the caregivers perceived and understood to be the risk factors of flooding. Almost all the caregivers acknowledged and understood that they were extremely exposed to the risk factors of flooding (see Figure 17). However, 4% of the caregivers indicated that they were not at risk of flooding. Most of the caregivers (47%) perceived the location of the settlement as a risk factor, while 33% of the caregivers reported that the type of houses in the area was a risk factor for flooding. Inadequate drainage systems and climate change were

perceived to present the least risk (4% each) for flooding. It is therefore clear that a significant number of the caregivers were aware of the risk factors.

**Figure 17: Perceived factors of flooding in Barcelona**

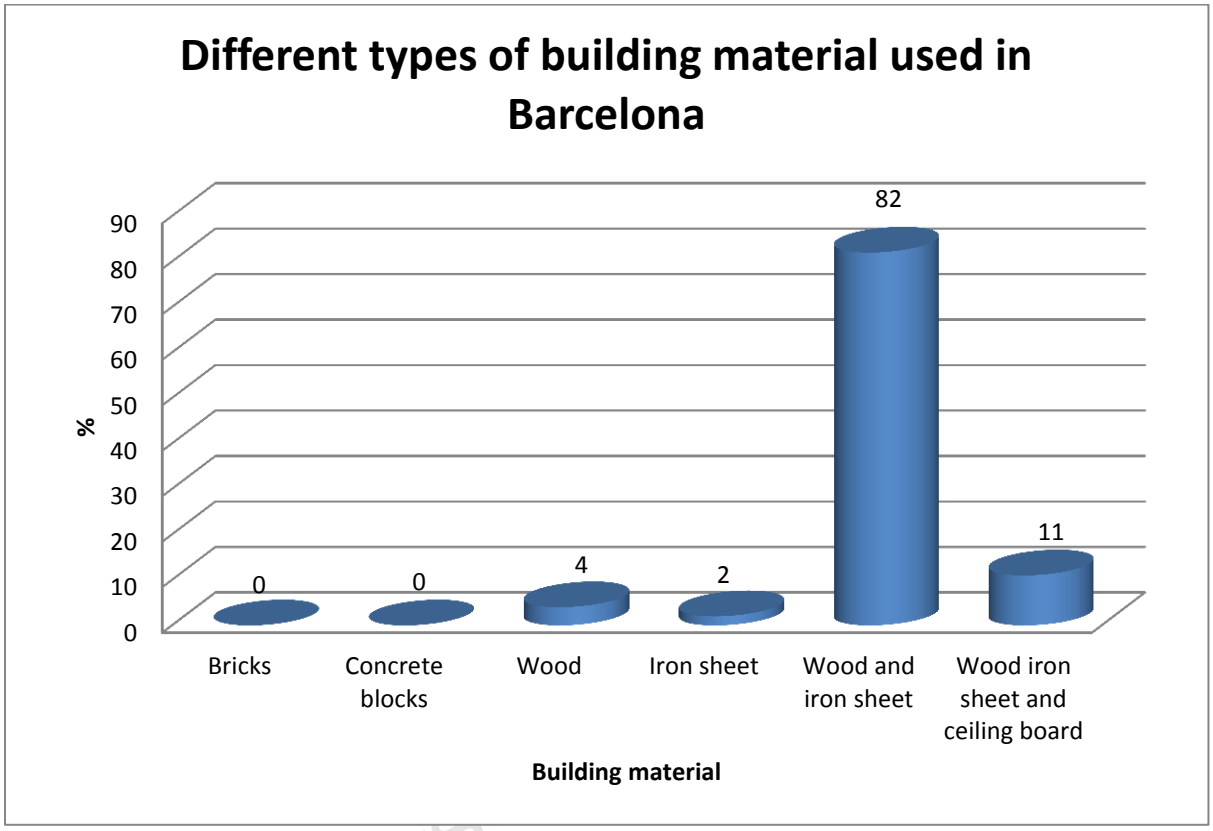



### 5.3.3. Construction material of dwellings

The types of dwellings that were found in Barcelona were primarily informal dwellings. Most of the dwellings were shacks constructed from various materials of different colours and textures. A significant number of the dwellings (82%) were built from a combination of wood and corrugated iron sheets. At the same time, there were a few dwellings (11%) which were built with a combination of three different types of materials – wood, corrugated iron sheets and ceiling board. Less common was the use of single materials, like wood (4%) and corrugated iron (2%). There were no dwellings that were built of strong building materials such as bricks and concrete blocks. This does not mean that the aforementioned building materials were necessarily poor, but, as some of the respondents indicated, they occasionally bought second hand building materials which were already damaged. All the dwellings had flat roofs. In addition to the poor

building materials, poor building practices (such as leaving gaps between roof and walls) exacerbate the risk of flooding in the dwelling.

**Figure 18: Types of building materials that were used on dwellings**




### 5.3.4. Height of floods in the dwelling and around

Flooding in the dwellings affected approximately 93% of the respondents, while 7% of the caregivers were not exposed to flooding in their dwellings. Continuous heavy rains coupled with poor and blocked drainage systems in Barcelona led to the rise in the levels of flood waters. This was further worsened by the fact that Barcelona is located in a low-lying area with a high water table. A significant number of respondents (89%) indicated that they experienced ankle-high flooding in their dwelling, while flooding height was recorded as lower or non-existent for the remaining caregivers' dwellings. 7% of the caregivers said that they experienced knee-high flooding in their dwellings. The results of such heights of water inside the dwelling were unsurprising considering that the dwellings were built on poor foundations, allowing water

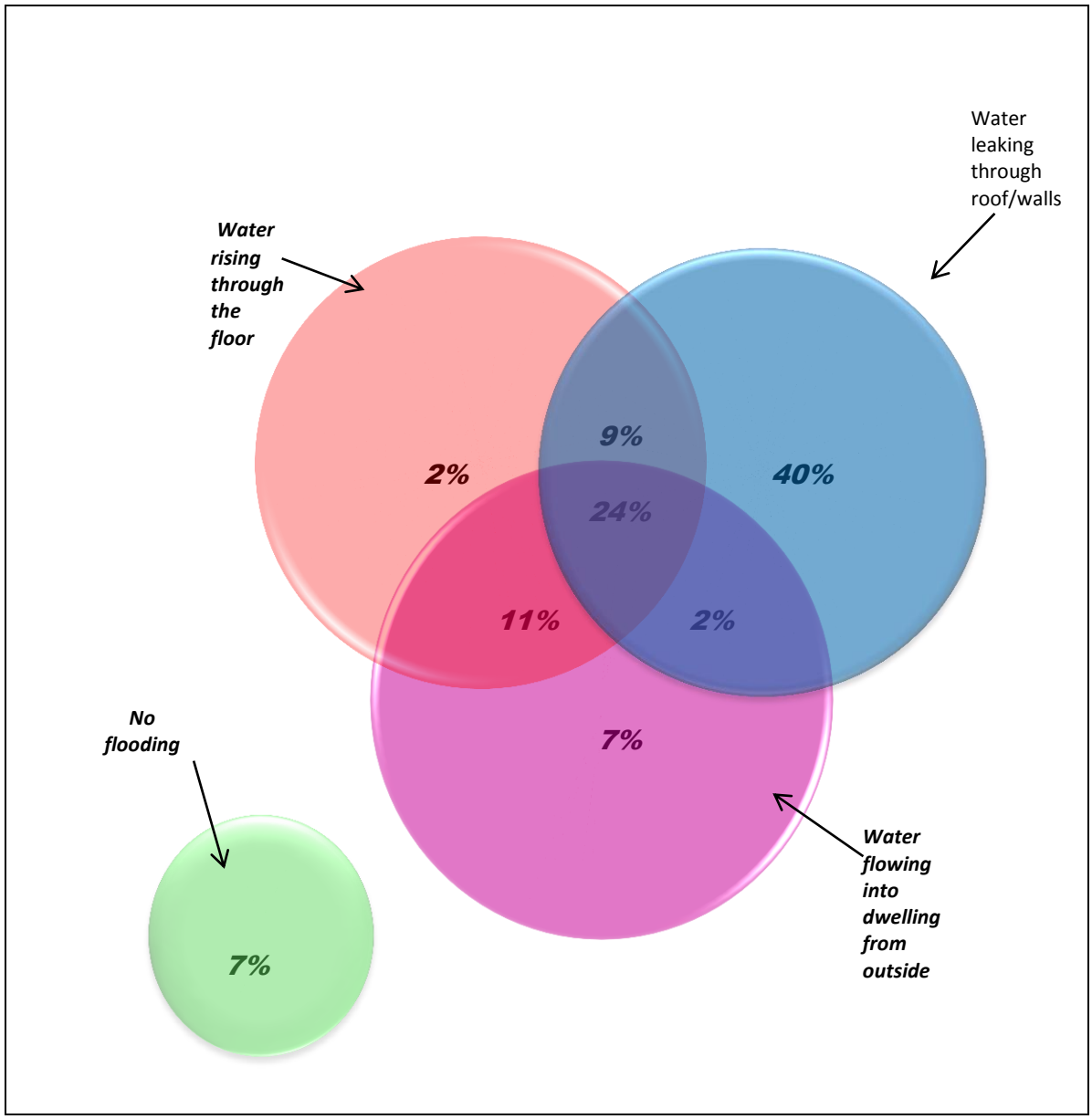
seepage into the dwellings, combined with the fact that the settlement is located in a low-lying area.

With regards to flood water around the neighborhood, 73% of the respondents indicated that it reached their ankles, and 20% of respondents indicated that flooding in the neighborhood reached knee height. Four types of flooding in the dwelling were experienced in Barcelona in the last 5 years (see Figure 19): 44% of the caregivers experienced water leaking through roof/walls; 28% experienced water rising through the floor; water flowing along the ground into dwellings from outside was experienced by 24% of the caregivers; and a few households (4%), who presumably had better-built dwellings and/or were located in areas with better drainage, did not experience any flooding in their dwellings. Focus group discussions indicated that the heights of children had an effect on exposure to flood water; the 0-10 year age group was particularly exposed because of their short stature (and because the youngest of this age group were still crawling). They are therefore in frequent contact with contaminated water. None of the caregivers indicated their dwellings being washed away by floodwaters.

### 5.3.5. Types of flooding

Leakage, seepage and storm-water run-off were some of the dominating forms of flooding. The above mentioned dominating forms of flooding were exacerbated by the fact that the settlement was located in an area with a high water table, with poor drainage and with dwellings built of poor materials. The households experienced seepage and storm water runoff flowing into the dwellings, through the door, the floor and through the roofs of the dwellings.

**Figure 19: Types of flooding that affected the community of flooding**




The Venn diagram in Figure 19 presents three types of flooding that were experienced in dwellings in Barcelona: water rising through the floor; water leaking through roof/walls and water flowing into dwelling from outside. From the intersections in Figure 19 one can clearly see that there are households in the area which experienced more than one type of flooding and there are also some households that did not experience flooding at all**.**

We can deduce important information from the Venn diagram, for example, the percentage of households which experienced water flooding through the floor and also water leaking through roof/walls is 11%.

Water leaking through roof/walls was not as prevalent as water rising through the floor and water flowing into dwellings from outside**.** Only 2% experienced water leaking through roof/walls exclusively, but all in all, 46% experienced this, with 44% experiencing other types of flooding as well besides water leaking through roof/walls. 46% is still a relatively high proportion, though. Coupling this with the above observations on water rising through the floor, one can safely conclude with some degree of confidence that flooding might be a problem but the way in which the houses are built and structured is also a contributing factor and needs to be looked at.

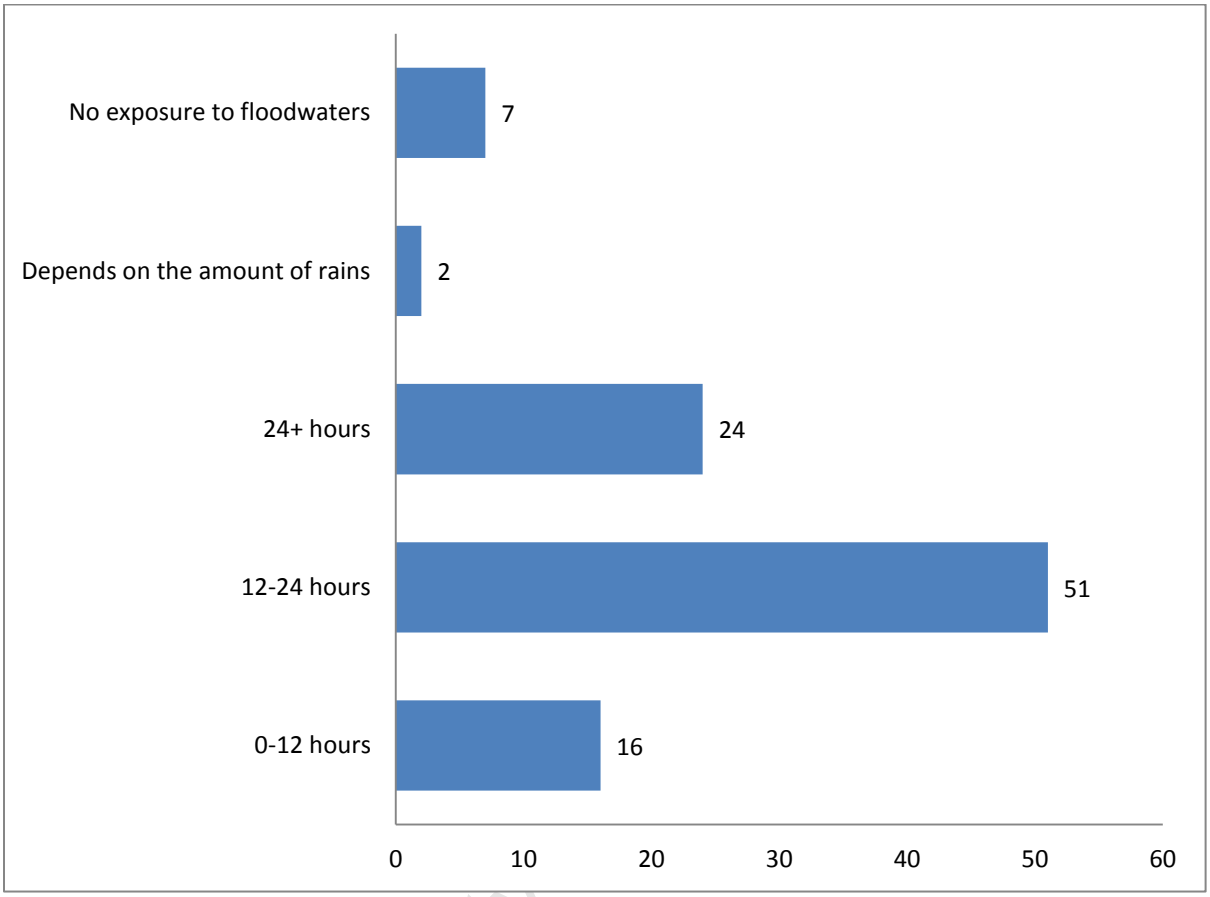
It seems that if roofing and flooring of the houses are given attention then we could see a large reduction in incidences of flooding in dwellings in informal settlements on the Cape Flats.

About 24% of the sample population was affected by all three types of floods, that is, water rising through the floor and water leaking through roof/walls and water flowing into the dwelling from outside.

### 5.3.6. Duration of floods

The period the informal settlement stayed flooded was important, as it helps in understanding how long the dwellings stayed flooded and how much time the caregivers took to clean their dwellings in order to reduce children's exposure to contaminated flood waters (see Figure 20). A large number of the respondents (51%) reported to have been exposed to flood waters for a period of 12-24 hours, while 24% of the respondents said that they were exposed to floodwaters for more than 24 hours. Meanwhile, 16% of the respondents indicated that they were exposed to floodwaters for a period of 0-12 hours, with 7% of the respondents indicating that they were not exposed to floodwaters at all. Lastly, 2% of the respondents indicated that their exposure to floodwaters depended on the amount of rainfall. The longer it stayed flooded the longer it took to clean the contaminated dwellings and the more the furniture was damaged. The longer it stayed flooded, the longer the children were exposed to the contaminated waters, resulting in flood-related illnesses.

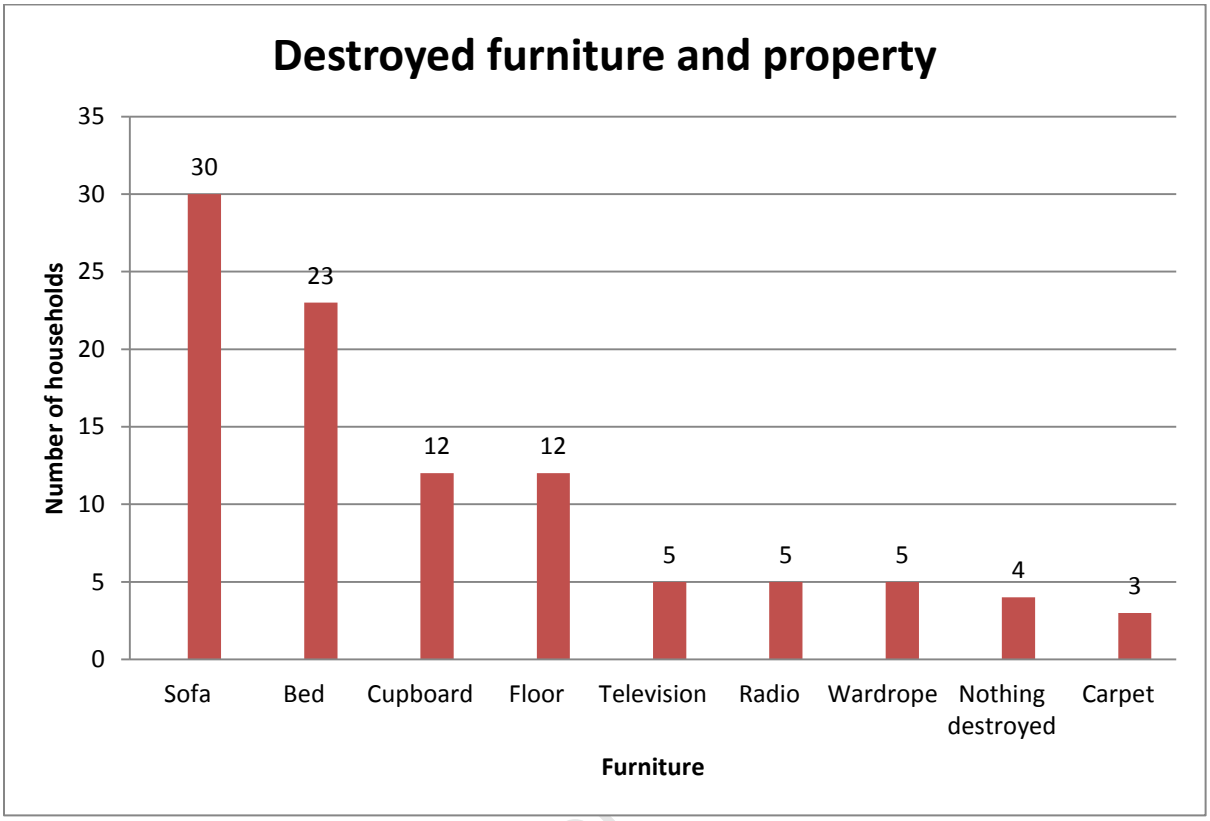
**Figure 20: Period of exposure to floodwaters**




### 5.3.7. Destruction of furniture

Figure 21 indicates the types of furniture destroyed by the winter floods in Barcelona. A large proportion of the caregivers (67%) claimed sofas to be the most damaged type of furniture during the winter periods, while beds (reported by 51% of the caregivers) were the second most damaged type of furniture. Radios and televisions were the least likely items to be destroyed. However, a few caregivers claimed not to have experienced any destruction of their property by the floods (see Figure 21). During the focus group discussions the caregivers claimed that two types of flooding destroyed their furniture the most and these were water rising through the floor and water flowing into the dwelling from outside. This reduced their economic base because they repeatedly had to buy the same type of property and repair their dwellings.

**Figure 21: Destroyed furniture and property**



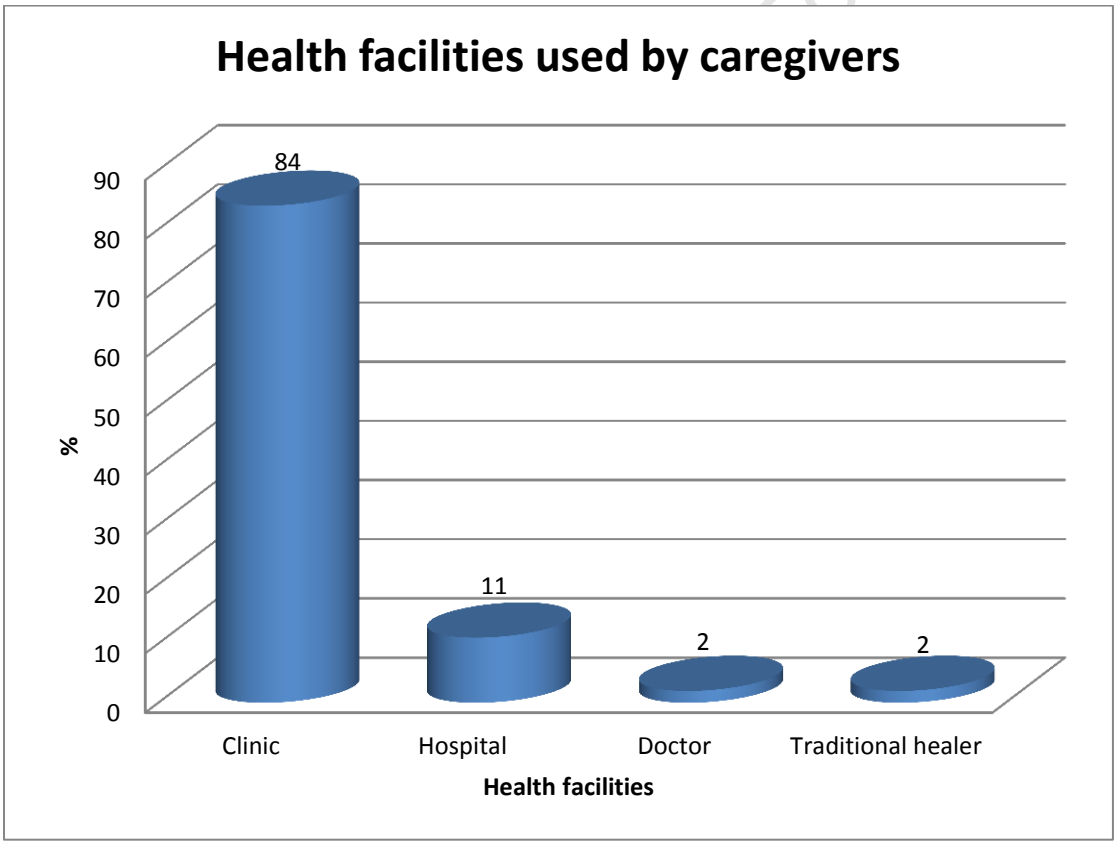

### 5.3.8. Health care facilities visited

Figure 22 below indicates the types of facilities that were utilized by the caregivers during the illness of their children. Research findings indicate that there were two types of health care facilities that were utilized by the caregivers in order to seek treatment for their children. The facilities were either informal or formal health care services. Formal health care services were favoured when compared to the informal health care services. Data from the focus group discussions explained why the formal health care services were preferred. In part, they personally trusted them and they considered the medication offered to be "clean" and "safe", as compared to that of informal health care services. Lastly, they believed that the informal health care services misled people for financial reasons. As a result the consultation of informal health care services was rarely practiced. As indicated in Figure 22, the health care facilities that were most frequently visited by the caregivers and their children were clinics. The majority of the caregivers (78%) preferred Vuyani clinic, because it was closer to the settlement, while 11% of the caregivers visited KTC and Heideveld hospitals, and a small proportion of the caregivers

indicated visiting health care facilities such as traditional healers (2%) and doctors (2%). The health care facilities were inundated by caregivers and their children especially during the winter season.

The results show that the caregivers were knowledgeable and knew how to access the type of health facilities when their children were unwell. A cross reference with the focus group discussions highlighted that the caregivers were aware of the implications of not taking their children to any health care facility. The implications they feared were the re-occurrence, high incidence rates and seriousness of the diseases. Therefore, the health care facilities were a source of information on how to reduce the occurrence of, and how to manage, diseases.

**Figure 22: Health care facilities visited by caregivers during the illness of their children**




### 5.3.9. Overview of social impacts

Most of the dwellings sustained damage mainly to the physical structure, leading to the destruction of various household properties. Flooding in Barcelona affected 60% of the working

population in the sample, resulting in absenteeism from work caused by the need to fix houses and to accompany children to the health care facilities. Absenteeism had a negative impact on the household's income because all the formally employed individuals were paid on an hourly basis, therefore, "*the more days you miss the more money you lose"* (Maria[2], 23 May 2012). Flooding can therefore cause financial hardships if one misses days from work. The duration of flooding had an effect on the health of children; the longer it stayed flooded the more children were exposed to flood-related illnesses. Lastly, the caregivers' preferred to consult formal health care facilities as compared to informal health care facilities.

## 5.4. FLOOD-RELATED CHILDHOOD ILLNESSES

There were five types of water-related childhood illnesses that were recorded in Barcelona (refer to Table 3). These were categorized as respiratory infections, gastrointestinal infections, vector-borne illnesses, skin and ear infections and "other" (Fewtrell and Kay, 2006). The types of illnesses were analyzed in relation to variables such as location, age, sex.

The most common type of illnesses was from the respiratory infections category, with the least from vector-borne illnesses. Exposure to viruses, bacteria and fungi that led to the above mentioned types of illnesses was contracted at home, alleys around the dwellings, roads, schools and playing areas.

**Table 3: Classes of water-related illnesses reported**

| Classes of illnesses | Illnesses | Exposure route |
|---|---|---|
| Respiratory infections | Asthma, TB, cough, runny nose, tonsillitis, throat infection, flu, cold and nose infection | Inhalation |
| Gastrointestinal infections | Stomach pains, diarrhea, and cholera | Ingestion |
| Vector-borne illnesses | Malaria | Mosquito bites |
| Skin and ear infections | Ear infections, rash, eczema and ringworms | Wounds and exudates |
| Others | Headaches and fever | |

[2] Not her real name, this also applies for every name that is used in this research

### 5.4.2. Caregivers' perception of threats/risks to child health

This section attempts to describe the causal chain that result in child flood-related illnesses. The causal chain is classified as "*sources of risk*" (Renn, 2008). One of this study's aim was therefore to characterize and identify the caregivers' perceptions of threats which caused flood-related childhood illnesses.

**Picture 3: Sources of risk**


| | Key |
|---|---|
| **A** | Mould in the house |
| **B** | Playing in contaminated waters without shoes |
| **C** | Unsanitary location of basic services |
| **D** | Children playing with contaminated flood waters |
| **E** | Children playing in contaminated water puddles |
| **F** | Unsanitary living and playing conditions |

**Table 4: Location of threats and causes of childhood illnesses on a household level**

| Location | Threats/causes |
|---|---|
| Inside the dwelling | Flood waters in the dwelling<br>Mould in the dwelling<br>Dampness in the dwelling |
| Outside the dwelling | Flood waters around the house<br>Drinking polluted water while playing<br>Playing in polluted water |

Table 4 and Picture 3 highlight the location and the perceived threats/causes of flood-related illnesses in children. The threats were divided into two locations; inside the dwelling and outside the dwelling. Threats that were found inside the dwelling included flood waters inside the dwelling, mould in the dwelling and dampness in the dwelling. Threats that were found outside the dwelling were: flood waters around the house, drinking of polluted water while playing, and playing in polluted waters.

Data from the focus group discussions indicated that size of the family, and the ages of children, has a dramatic impact on the incidence of flood-related illnesses. The larger the number of children in a household the more difficult it was for caregivers to reduce the risks of flood-related illnesses, especially the skin and ear infection. This is illustrated in an excerpt from Sarah[3], a 22 year old mother:

*It is very difficult for me to see to it that my young 1 year 7 months and 7 months old children are not exposed to the flood-contaminated floor and ground. I cannot carry them both at the same time, especially after a flood, because I need to clean the house and perform other duties. Hence when I put one on the ground he is likely to put his dirty contaminated hands into his mouth and play on the contaminated ground.*



### 5.4.2.1. Diseases incidences in relation to location

Question 34 (refer to appendix 1) was a multi-response question so the analysis was based on the number of mentions of the ***Inside*** or ***Outside*** the dwelling risks from the caregivers whose

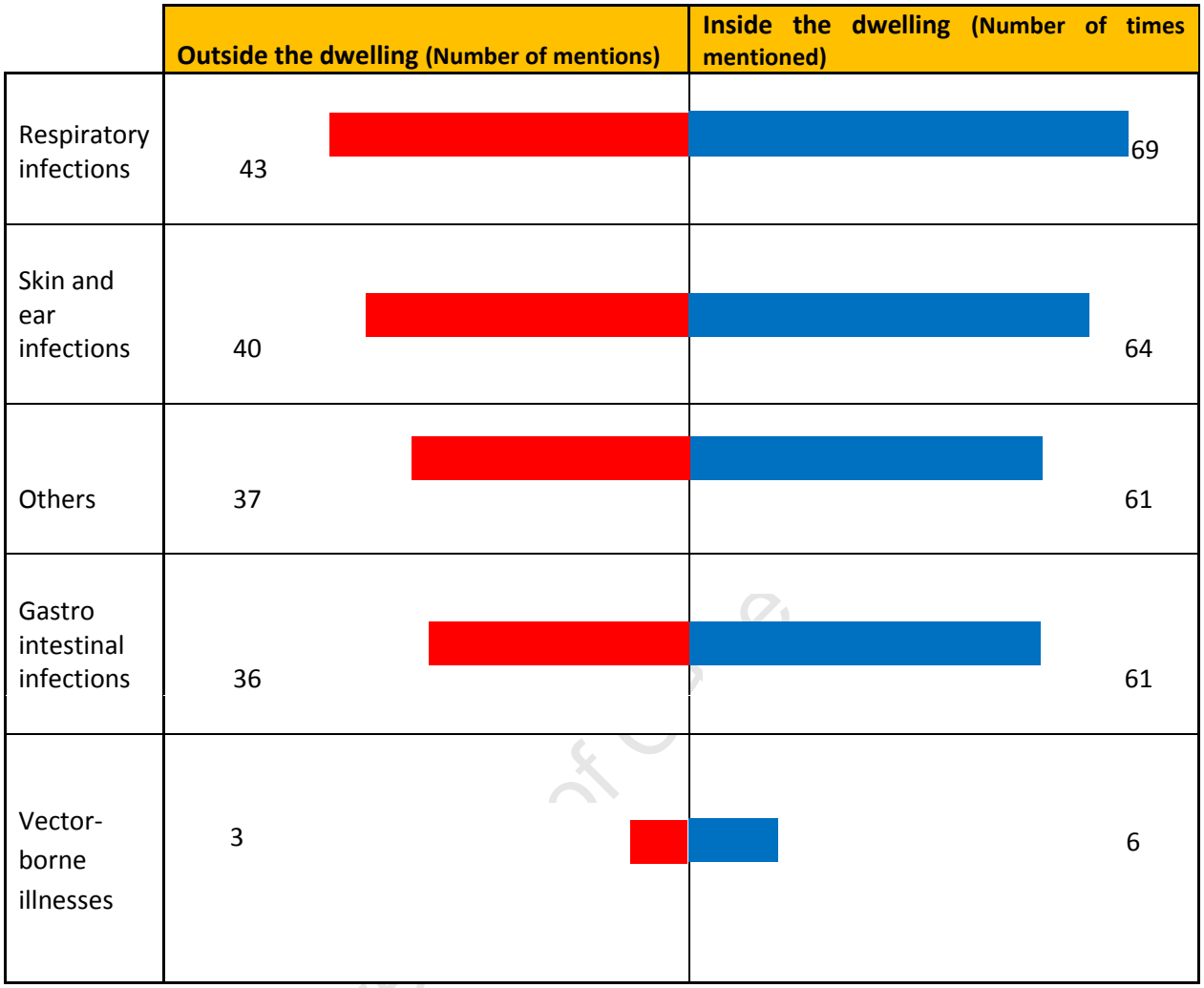
[3] Not real name

children suffered from a specific illness. So if a risk got more mentions than the other it means that it was viewed/perceived as the most dangerous.

Most endangering threats/causes were perceived to be located inside the dwelling, with the least threats being recorded outside the dwelling. The threats/causes that were located outside the dwelling were perceived to be less detrimental to children's health. Data from the focus group discussions indicated that more threats were located inside the dwelling because during the winter periods children were forced to stay indoors, where they were exposed to airborne droplets of ill household members, mould, aerosols, wet carpets/floors and poor ventilation. Children were less aware of the threats located inside the dwelling for the reason that it is these children's comfort zone, so they are less likely to perceive their dwellings as a threat, while they are continuously informed by their caregivers about the dangers outside the dwelling. However, it is evident that flood-related illnesses were more likely to occur from threats inside the dwelling than threats from outside the dwelling (refer to Figure 23). Across all illness types inside the dwelling got about 22% more mentions than outside the dwelling (save for illness Type E (refer to Figure 23), because the number of caregivers who mentioned it were very low - only 2 cases were reported).

The research findings mean that if we are to make inferences to mitigate the type of illnesses it would be more logical to give more focus and resources on threats arising from indoors. On the other hand, threats arising from the outdoor environment should not be discounted. It is important that threats from both indoors and outdoors should be addressed.

**Figure 23: Relationship between location and type of flood-related childhood illnesses**




Data from the focus group interviews revealed that boys were generally more exposed to the risks outside the dwelling in comparison to girls because boys were more likely to be allowed to play outside than girls.

### 5.4.3. Sex –illness ratio

This section is going to focus on the sex-illness ratio of the children in Barcelona. The sex-illness ratio is a ratio which defines how likely an illness type is going to affect a certain sex group more or less than the other group. The average number of incidences of illnesses per boy/girl was used to understand the occurrence of illnesses in relationship to sex.

**Table 5: Classes of illnesses in relation to sex**

| | Girls (n = 22) | | Boys (n = 23) | | Total (n = 45) | |
|---|---|---|---|---|---|---|
| **Illnesses** | **Number** | **Mean** | **Number** | **Mean** | **Number** | **Mean** |
| **Respiratory infections** | 99 | 4.5 | 114 | 5.0 | 213 | 4.7 |
| **Gastro. infections** | 24 | 1.1 | 24 | 1.0 | 48 | 1.1 |
| **Vector-borne** | 2 | 0.1 | 0 | 0.0 | 2 | 0.04 |
| **Skin/ear infections** | 23 | 1.0 | 37 | 1.6 | 60 | 1.3 |
| **Others** | 38 | 1.7 | 26 | 1.1 | 64 | 1.4 |
| **Total** | **186** | **8.5** | **201** | **8.7** | **387** | **8.6** |

These figures are based on a count of 23 boys and 22 girls. The illness question on which Table 5 is based was a multi-response question based on non-mutual exclusiveness of the illnesses, so the frequencies are based on the number of mentions a respondent gave per child. The information in Table 5 indicates that there were a total of 387 cases of flood-related illnesses that were recorded. The rates of incidences for most illnesses were similar for boys and girls, but boys were 60% more likely to have had skin/ear infections than girls, and girls were 50% more likely to have had "other" flood-related illnesses than boys.

### 5.4.4. Causal link of flood-related childhood illnesses

Table 6 illustrates the causal links of the household and environment risks, and highlights that age and sex of children was a major factor in distinguishing how vulnerable the children were to flood-related illnesses. From Table 6 one can see that boys aged 6-10 years were greatly exposed to household and environment risks for the simple reason that their playing habits, playing areas and contaminated toys made them more susceptible to flood-related illnesses. This was evident in the increased rates of flood-related illnesses incidences in comparison to other age groups. Older children, in the 11-18 age group, were less vulnerable to flood-related illnesses and hence recorded low incidence rates in comparison to younger age groups. This is further supported by Figure 23, which highlights that the 0-10 year age groups were more exposed to flooding illnesses as compared to other age groups. Undoubtedly, the 0-5 age group was more exposed to illnesses since children aged from about 5 months to 2 years are crawling and the 3-5 year olds are of small stature, meaning they are close to the ground/floor as compared to older children.

## Table 6: Perceived causual chain of childhood illnesses in relation to playing area

| Sex | Age | Source of risk | Perceived causal chain | Playing area | Realized illnesses |
|---|---|---|---|---|---|
| **Girls** | **0-5** | Getting into contact with contaminated floors and open ground, mould in the house Contaminated waters | The youngest of the group are still crawling and touching the contaminated floor and ground, Their short stature close to the ground Putting to mouth everything they come into contact with Touching of eyes with contaminated hands, inhalation of mould, aerosols | Alleys between dwellings , home and crèche | Skin infections, diarrhoea, ringworms, stomach pains, Malaria |
| | **6-10** | Polluted waters and the rains, mould in the house, | Exposed to rains to and from school, play in polluted waters when coming from school and during weekends, inhalation of mould, aerosols | Roads, school, alleys between dwellings, home | Skin infections, cough, cold, fever, runny nose, ringworms, malaria |
| | **11-15** | Polluted waters and rains, mould in the house | Exposed to rains to and from school, inhalation of mould, aerosols | Roads and school, home | Cough , cold, runny nose, flu, asthma |
| | **16-18** | Rains, polluted waters and mould | Exposed to rains to and from school. | School and roads and home | Cough, cold, flu and throat infections |
| **Boys** | **0-5** | Floor and open ground | Crawling and touching the contaminated floors and ground, touching of eyes with contaminated hands, inhalation of mould, aerosols | Alleys between dwellings , home, crèche | Skin infections, diarrhoea and ringworms |
| | **6-10** | Polluted waters, rains and mould in the house, | Exposed to rains to and from school, exposure to polluted waters when the playing in the dwelling and community, inhalation of mould, aerosols | Playground, School, Road, alleys between dwellings, canal, home | Ear infections, Skin infections, cold, flu, fever, headaches, asthma, ringworm, throat infections stomach infections, diarrhoea |
| | **11-15** | Rains, mouldin the house and polluted waters | Exposed to rains to and fro school, and the mould in the house exposure to polluted waters in the house, inhalation of mouldaerosols | School and roads, home | Cough, colds, runny nose |
| | **16-18** | Polluted | Exposed to rains to and fro school, and the mould in the house exposure to polluted waters in the house, inhalation of mould aerosols | School and roads, home | Cough, and colds |

### 5.4.5. Sex and age differences in incidences of flood-related illnesses

In this section, sex and age variables in relation to incidences of flood-related illnesses are explored through discussions from the focus groups. In the focus group discussions it was highlighted that boys were more likely to fall sick from flood-related illnesses as discussed below.

During the focus group interviews there were significantly higher references to girls and boys within the 0-5 year age group being more susceptible to respiratory infections and skin and ear infections as compared to other age groups. Caregivers indicated that their infants and toddlers were particularly susceptible to flood-related illnesses because of their poor developing immune systems, their crawling, and their hand to mouth behavior. In other words, infants and toddlers put anything they come in contact with to their mouths, unlike the older children. As a result, the aforementioned acts make them more susceptible to gastrointestinal illnesses as well.

In the same manner, data from the focus group discussions indicated that perceptions of risks by boys within the 6-15 age group were completely different from the way girls within the same age groups perceived risks. The caregivers indicated that boys did not perceive playing with flood polluted waters as detrimental to health, or even playing outdoors without warm clothes and shoes. Boys, unlike girls of the 6-15 age group were further exposed to flood-related illnesses from outside the dwelling because they were given more freedom whereas girls were not granted such freedom: "… *I am not really worried about my boy child when it comes to playing outside the dwelling, because I know he can take proper care of himself, but I worry more about my girl child*." (Thuli, 2 June 2012).

The least susceptible age group to flood-related illnesses was the 16-18 age group, because this age group was perceived to be responsible and better informed about illnesses during winter. Hence they applied personal strategies such as wearing warm clothes, avoiding contaminated flood waters, cleaning the house, taking of medication where necessary. Thus, this age group was able to better mitigate risk of flood-related illnesses as compared to the younger age groups.

The effects of flood-related illnesses on children in Barcelona had ripple effects, especially for the school going ages. The illnesses promoted school absenteeism. Most caregivers from the

focus group discussions indicated that school absenteeism had had negative impacts on their children's school reports. Hence there was a correlation between flood-related illnesses and decent school results.

## 5.5. MEASURES PUT IN PLACE TO PROTECT CHILDREN FROM FLOOD-RELATED ILLNESSES.

Having highlighted the types of childhood illnesses from flooding this section turns its focus on responses to childhood illness impacts, with the help of the vulnerability concept.

### 5.5.1. Protective laws, policies, strategies and regulations

The study investigated the caregivers' awareness of any laws, policies, strategies and regulations that aimed at protecting their children from the impacts of flooding. The research findings showed that there is poor awareness of any laws, policies and regulations that aimed to protect the caregivers' children from flood-related illnesses.

### 5.5.2. Health related coping strategies/mechanisms

Research findings indicated that households applied a number of interventions in-order to evade and reduce the incursion of polluted floodwaters into their living spaces (see Table 7). For this reason, the research laid its primary focus on the type of coping strategies applied by the caregivers to protect their children in their homes and playing areas. The types of coping strategies of the vulnerable communities are considered at household level (divided into children and caregivers) and community level. The strategies were carried out as either reactive or proactive. Proactive measures were actions that were conducted before the flooding, while reactive measures were put into practice after the flooding. Table 7 indicates that caregivers provided most of the coping strategies, while the community provided little or insignificant coping strategies. At the same time, the older children (11-18 years) applied coping strategies for themselves and for their younger siblings.

**Table 7: Formal and informal health related coping strategies of vulnerable children, caregivers and the community**

| Coping strategies | | Type of strategy |
|---|---|---|
| **Children** | Avoidance of floodwaters when playing | **Proactive** |
| | Wearing of warm clothes | **Proactive** |
| | Playing/staying indoors | **Proactive** |
| | Carrying of young siblings on their backs, or in their arms | **Proactive** |
| | Restricting their younger siblings from playing in polluted water | **Proactive** |
| | Assist in cleaning the house after a flood | **Reactive** |
| **Caregivers** | Purchase of medication before child illnesses | **Proactive** |
| | Purchase of medication during child illnesses | **Reactive** |
| | Inform children to avoid floodwaters | **Proactive** |
| | Cleaning the house after a flood | **Reactive** |
| | Bath children before they go to bed | **Reactive** |
| | Dress children in warm clothes | **Proactive** |
| | Making children sleep on the bed | **Reactive** |
| | Temporarily moving children to a relative during the winter period | **Proactive** |
| | Take children to clinic or hospital | **Reactive** |
| | Force children to stay indoors | **Proactive** |

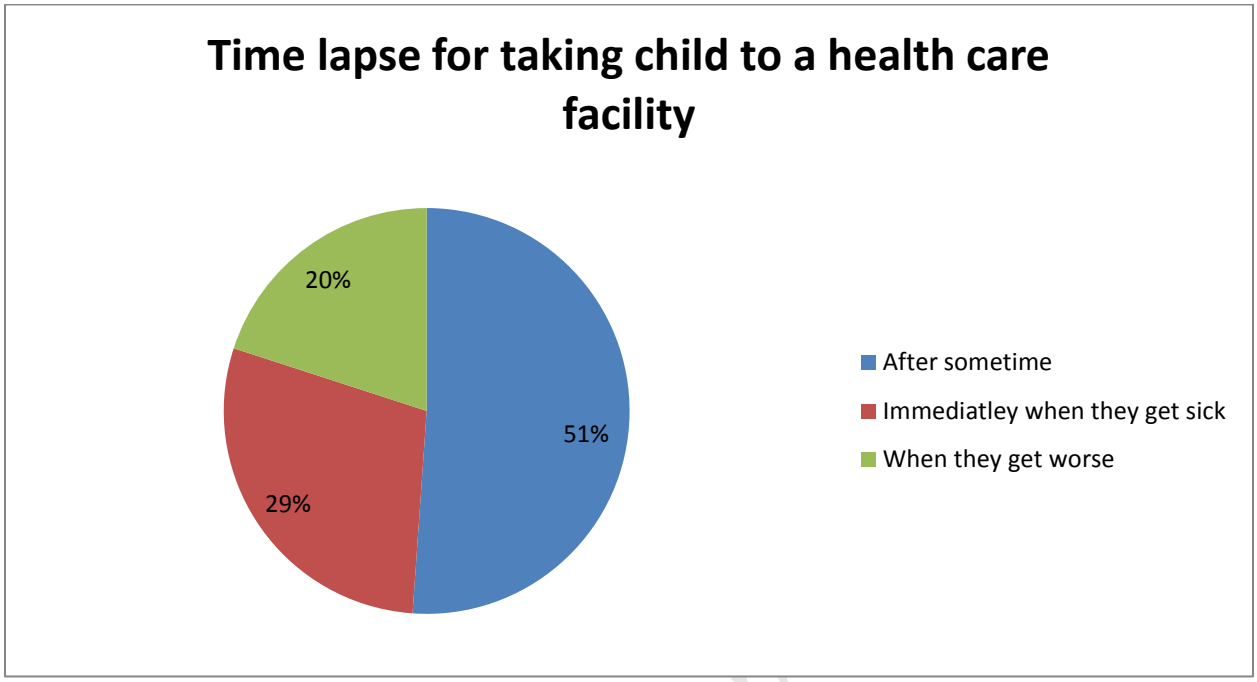
| | | |
|---|---|---|
| | Carrying of child on one's back or arms | **Reactive** |
| | Use of a paraffin heater to keep the children warm in cold weather | **Both reactive and proactive** |
| | Flood proof the house | **Reactive** |
| | Warming the room by placing blankets on the floor | **Reactive** |
| | Raising of the house from the ground | **Reactive** |
| | Raising the front of the house to stop water from entering | **Reactive** |
| | Providing a balanced diet for the children | **Proactive** |
| | Providing warm clothes and shoes for the children | **Proactive** |
| | Use of containers to catch leaking water | **Reactive** |
| **Community** | Provide shelter - following flooding, some neighbours offered accommodation to some of the people whose houses were flooded. | **Reactive** |



### 5.5.3. Health seeking behaviours

All the caregivers sought medical advice for the type of illnesses that affected their children. The time it took the caregivers to seek the medical advice varied from household to household (see Figure 24). The time lapse for seeking medical advice was further categorized into three components. The first component constituted caregivers who took their children to a health facility "sometime after they got sick" (51%).

**Figure 24: Time lapses for taking child to a health care facility**




The second category had caregivers who visited a health facility "immediately when their children got sick" (29%). The third and last category reported that they took their children to a health facility "when their children got worse" (20%). In the case of the first and third categories, children were not taken to a health facility immediately, and the reasons for such acts varied (as outlined in Table 8).

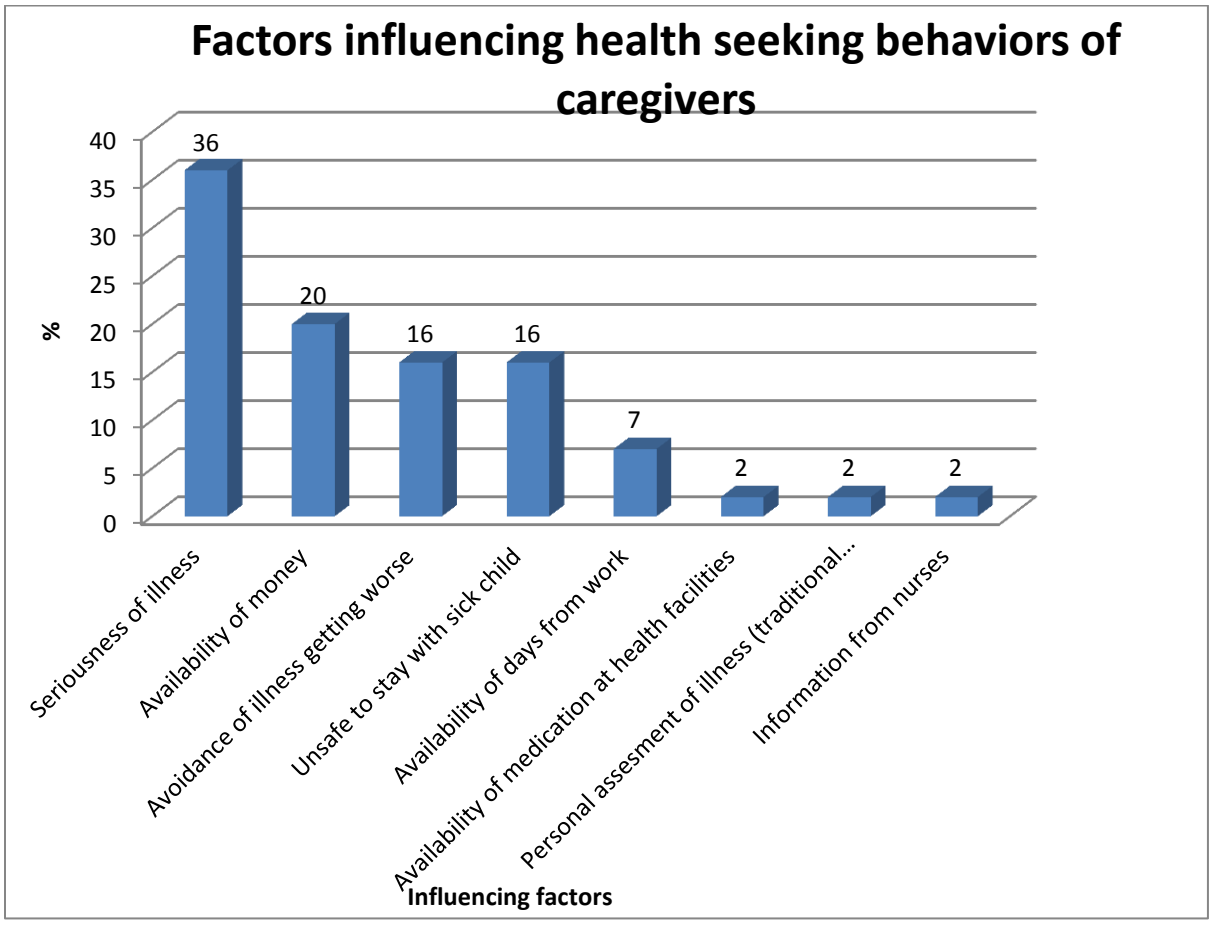
**Table 8: Reasons for taking child to a health facility after a certain waiting period**

| *After they got worse (Category 1)* | *Sometime after they got worse(Category 3)* |
|---|---|
| ***Scared of losing child through death*** | *Depends on availability of days away from work* |
| ***Sad to see one's child not being able to eat and play because he/she is not feeling well*** | *Depends on availability of purchased medication at home (self-care)* |
| ***Delays through consultation of a traditional healer*** | *Avoidance of illness getting worse* |
| | *Personal assessment of illness at home* |
| | *Father not interested* |
| | *Avoidance of waiting in long queues for an illness that might not be detrimental* |

The findings from the research show that health seeking strategies of the caregivers in Barcelona varied from household to household. The treatment seeking patterns in Barcelona were divided

into three patterns. The first, and most common, was the consulting of formal medical practitioners, which was recorded for 98% of the caregivers. At the same time there was one caregiver that consulted informal medical practitioners. The last medical seeking pattern was consultation of formal and informal medical practitioners. Further analysis of data from focus group interviews indicates that there was little reliance on informal medical practitioners. The above explanations prompted the researcher to examine factors influencing health seeking behaviors among the caregivers (see Figure 25).

**Figure 25: Factors influencing health seeking behaviours among caregivers**




In Figure 25 we explore the factors influencing health seeking behaviors of medical help by caregivers when a child fell ill this was determined by various aspects in Barcelona. Firstly, in all cases clinic or hospital hours/times coincided with the working hours of the caregivers.

The factors varied from "seriousness of the illness", which had the highest number of respondents (36%) to "information from nurses" (2%). A significant number of the caregivers

sought medical care for their children when they perceived the illness as detrimental. Hence, children suffered for days as a result of the caregivers' poor diagnosis of the illness. On the contrary, some caregivers sought medical care because it was considered unsafe to stay at home with a sick child (16%). For other caregivers, the thought of staying home with a sick child was unsafe but they had other limiting factors such as unavailability of days away from work (7%), while others reported having had to weigh the option of going to a medical care facility where medication might be unavailable (2%). Interestingly, there was a case where a caregiver did not seek formal medical health care because she was a traditional healer (2%). The likelihood of caregivers seeking medical care for their children was positively predicted by seriousness of illness; this was supported by data from the focus group interviews. Discussions from the focus group interviews indicated that when the child was seriously ill the caregivers were not concerned about unavailability of days away from work or unavailability of money, rather they would not attend work and borrow money from friends or family members in order to seek medical advice. This is clearly illustrated in the excerpt below by Naledi (3 June, 2012):

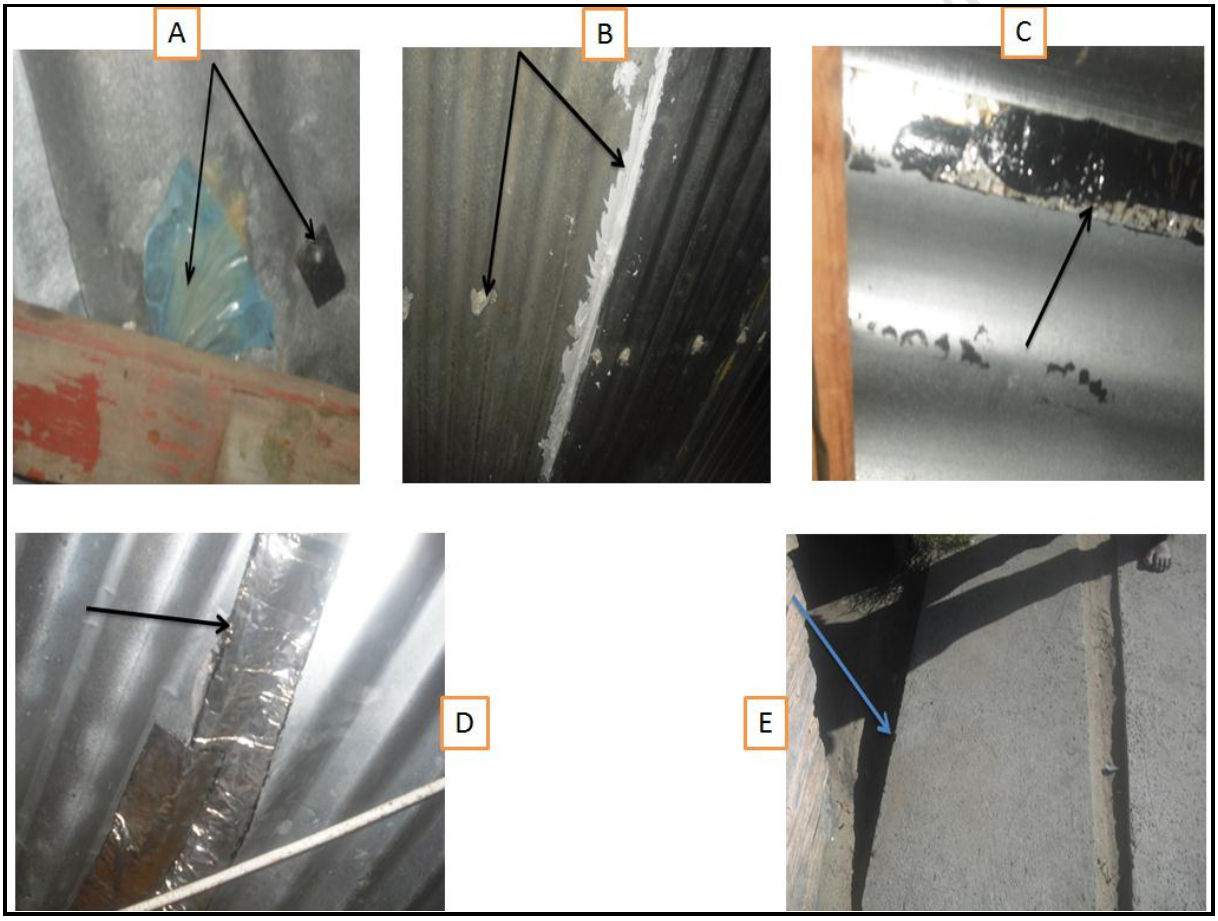
"*…yes, ladies, we have to put all these factors into consideration. You might hear me saying I don't have money or I am not going to miss any days away from work, but when my child is seriously ill, the honest truth, I will not worry about losing my job or not having money, I will borrow from someone the money in order to save my child's life. It will not be good to lose your child due to these flood-related illnesses, just because we want to save our jobs*."

### 5.5.4. Physical adjustment of dwelling and area around dwelling

Table 9 and Picture 4 below present the types of adjustments that were carried out by the caregivers. The physical adjustments of the dwelling and the area around the dwelling were classified into two types of adjustments: proactive and reactive. These types of adjustments were applied in order to avert or reduce water from seeping, leaking, ponding in the living spaces. The caregivers predominantly applied proactive adjustments rather than reactive adjustments. Compared to the reactive adjustments, those who used proactive adjustments reported that they were expensive but were effective, unlike the reactive adjustments that were cheap and did not require much time. During the focus group interviews, those who had applied proactive adjustments to their dwellings and around their dwellings indicated that their children were at

low risk of contracting flood related illness as compared to their counterparts. The most popular types of dwelling adjustments focused on leakages, with particular attention on sealing. Actions like sealing roof and wall holes with silicone (88%) and Vaseline (6%) were undertaken frequently because they were inexpensive measures. On the other hand, sealing holes with tar and foil paper (4%) was applied and was regarded as a measure that was effective and had high endurance level because of its adhesive force, unlike Vaseline and silicone, while a concrete slab was used by 2%. However, the latter two were the least used measures for the simple reason that they were not easily obtainable.

**Picture 4: Adaptive measures applied**



| | Key |
|---|---|
| A | Applying of Vaseline on plastic to seal the hole and burning an old tyre rubber on the hole |
| B | Applying of silicone on lines of weakness and holes |
| C | Applying tar on lines of weakness an holes |
| D | Use of foil paper to cover lines of weakness |
| E | Layering of a concrete slab on the front door so that water flows away from the house |

Regardless of the fact that the use of stilts (2%) and concrete floors (2%) was helpful and very effective, they were the least used type of adjustments, because they were regarded as being extremely expensive. The use of carpets or blankets on the floor was very popular (86%), yet at the same time the caregivers complained that during flooding the wet carpets or blankets increased the coldness in the house, resulting in illnesses such as colds, flu and increased asthma attacks affecting their children. The strategy of digging trenches around one's house to channel water away from the dwelling was considered effective, but only to a certain degree, because digging trenches channeled the flowing water to surrounding dwellings. Therefore, digging trenches was only effective when conducted by the community as a whole with a well outlined plan, indicating where the trench was to be laid and its course.

**Table 9: Physical adjustment of dwelling and area around the dwelling**

| **Adjustment focus** | **Proactive adjustment** | | | **Reactive adjustment** | | |
|---|---|---|---|---|---|---|
| | **Type** | **Effectiveness** | **Cost** | **Type** | **Effectiveness** | **Cost** |
| **wetland** | Dwelling lifted from ground by use of stilts | Very effective | ± R1000 | Dig a trench around the dwelling when the water puddles | Not very effective, but it keeps water from the house for sometime | No cost |
| | Building a concrete floor for the dwelling | Very effective | ±R1600 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Leakage** | Layering a ceiling board on the roof<br><br>Cover roof with thick plastic sheet<br><br>Sealing of roof holes with silicone<br><br>Sealing of roof holes with Vaseline-covered plastic<br>Sealing of holes with tar | Very effective<br><br>Effective if the winds are not powerful<br><br>Helps a little<br><br>Helps a little | ± R500<br><br>±1000<br><br>±45<br><br>±10 | Use containers to collect rainwater | Helps a little | No cost |
| **Ponding** | Growing a lawn around the dwelling | Effective<br>There is little surface runoff and the , the lawn helps in seepage of the flooding waters | No cost experienced | Place stepping stones outside the dwelling's entrance when the water floods outside the dwelling<br><br>Use of sand and gravel to elevate the ground around the dwelling when the water floods outside the dwelling<br><br>Dig a trench around the dwelling during flooding | Helps a little<br><br>Effective<br><br>Helps a little | No cost<br><br>No cost<br><br>No cost |
| **Seepage (water seeping upwards from the ground)** | Building a concrete floor for the dwelling<br><br>Put a carpet or blankets on the floor | Very effective<br><br>Not effective | ± R200<br><br>±R100 | Mop the water | Not effective | No cost |

## 5.6. SUMMARY

The findings from this study indicate that there were high levels of awareness of health- related coping strategies in Barcelona applied by the caregiver. All the caregivers sought medical attention when their children succumbed to any flood-related illness, however, the time it took the caregiver to seek medical attention relied very much on the attitude of the caregiver. Furthermore, the respondents generally preferred proactive adjustments in order to reduce flooding in their dwellings and the surrounding areas than reactive measures.

# CHAPTER 6: DISCUSSION AND CONCLUSION

## 6.1. INTRODUCTION

The focus of this chapter is on discussing the research findings in relation to key studies on flood-related childhood illnesses, the research objectives and the conceptual framework. It is important to understand that there is limited research on the health effects of flooding (Ahern et al. 2005; Few and Matthies, 2006; Holloway and Roomaney, 2008), especially in relation to child illnesses. The discussion will be done through the lens of the vulnerability framework. The research objectives were:

1. Establishing of factors and other stressors that determine the occurrence or incidence of waterborne illnesses among children in informal settlements as a result of flooding;
2. To explore and identify the flood-related childhood illnesses;
3. To identify strategies households apply in order to protect their children from flood-related illnesses.

This chapter discusses the key findings of the study and makes recommendations.

## 6.2. DISCUSSION OF RESEARCH FINDINGS

The purpose of this study was to understand the impacts of flooding on children's health in the informal settlement of Barcelona, Cape Town. This was achieved by analysing the existing risks and impacts of urban flooding on the health of children that live in the informal settlement. Firstly, the study established the household characteristics that were linked to childhood flood-related illnesses. Secondly, the study explored the spatial disparities in the incidence of flood-related illnesses, by carefully considering the availability of basic services and the location of Barcelona and other stressors.

The research findings suggest that there was a high prevalence of flood-related childhood illnesses in Barcelona following flooding. This resulted from factors such as a lack of adequate housing and services, coming into contact with contaminated flood waters, mould, children's age and sex, and the type of flooding. The above mentioned factors were established through the use of both qualitative and quantitative research methodologies. The types of illnesses identified

were respiratory illnesses, gastrointestinal illnesses, skin and ear infections, vector-borne illnesses and other flood-related illnesses. These were identified by the caregivers' recall.

Factors that led to flood-related childhood illnesses were then conceptualized in a vulnerability framework similar to that used by Turner and colleagues (2003). The framework is used in order to examine the vulnerability of children to flood-related health impacts with the main focus on exposure, susceptibility and resilience.

The vulnerability of children of Barcelona can be represented as a general equation below (Turner et al. 2003):

$$Vulnerability = Exposure + Susceptibility - Resilience$$

The research findings indicate that the issue of flood vulnerability exists in Barcelona. It is revealed in a number of ways. There are conditions that generate the vulnerability of the children in Barcelona; these include the governance, social, environmental, economic and demographic contexts. Applying the research findings to the vulnerability framework makes it possible to understand that vulnerability plays a vital role in flood risk generation and it highlights the associated impacts, particularly on child health (Few and Matthies, 2006).

***Research objective 1**: Establishing of factors and other stressors that determine the occurrence or incidence of waterborne illnesses among children in informal settlements as a result of flooding*

### 6.2.1. Exposure Factors influencing children's flood vulnerability

Although Barcelona is a vibrant community, there were several factors that were observed by the researcher that hindered quality of life in the settlement, especially for children. These included scarcity of resource and poor second hand construction materials which were already damaged. In addition most of the community members of Barcelona did not have access to resources that alleviated them from vulnerability /risk. The research findings have proved that there is a strong link between urban flood risk, poverty and child vulnerability. These findings were found to support research which indicated that children fell ill as a result of coming into contact with contaminated floodwater (Davis, 2006; Jha et al., 2012; WHO, 2005).

The findings of this study showed high levels of illnesses in children. The results might be attributed to poor living conditions in Barcelona, which are influenced by broader socio-economic factors. In addition, environmental problems such as inadequate sanitation and inadequate solid waste removal exacerbated the prevalence of infectious diseases. The same trend has been identified in other studies which indicate that the wide array of communicable diseases is supported by poor housing conditions and stressors such as mould in the house (Benjamin, 2005; Cairncross and Ouano, 1990; Tapsell et al., 2002).

### 6.2.2. Incidence of floods

The settlement of Barcelona experiences flooding annually, especially during winter seasons. The factors in this settlement that exacerbate the flooding hazard include lack of efficient storm water drainage systems, unplanned construction of shacks and uncontrolled dumping of solid waste. These findings indicate similarities with the factors identified in the study by Douglas et al. (2008) of five African cities.

The findings of this study suggest that there is increased occurrence of flooding in Barcelona. The findings are similar to those found in the literature, which indicate that there is an increase in the frequency and severity of flooding in Cape Town and Africa as a whole. In addition, the increased occurrence of flooding in Barcelona was a result of its location in a low-lying area with a high water table (Holloway and Roomaney, 2008). The research findings also indicated that increased flooding led to increased exposure, thus resulting in increased propagation of flood-related illnesses in children, which is similar to findings in the literature (Ahern et al. 2005; Du et al. 2010; Few and Matthies, 2006).

### 6.2.3. Location of risk

Location of risk plays a major role in determining the prevalence of flood-related illnesses. Research findings indicated that there were more flood-related illnesses that were associated with being inside the dwelling rather than being outside the dwelling. This might be due to the fact that the caregivers usually implicitly perceived being inside the dwelling to be safe as compared to being outside the dwelling, due to feelings of safety, protection and comfort associated with being in the dwelling, and they therefore pay less attention to threats inside the dwelling than

they do to threats outside the dwelling. Similarly, children regard the dwelling as a comfort zone, so they are less likely to perceive their dwellings as a threat

The research findings mean that if we are to make inferences to mitigate the types of illnesses it would be logical to give more focus and resources on threats inside the dwelling. All the same, it is important that threats outside the dwelling are not discounted.

### 6.2.4. Sex and age as influential factors to levels of exposure

On the other hand, social dimensions differentiate one's vulnerability to flooding (WHO, 2002). The research findings indicated that the rates at which boys were exposed to flood-related illnesses were higher compared to girls. Interestingly, boys were more exposed to flood risks that were located outside the dwelling as compared to girls. This is because boys were more active than girls. In addition, boys were granted more freedom than girls and often will sneak out of the house to play outside. These findings were also similar to the study by Rabbani and Alexander (2009).

Age influenced the exposure to illnesses. The 0-10 age groups were more exposed to flood-related illnesses because of their active playing habits - they often played with contaminated floodwater, as compared to the older children who were more aware of their playing environments. The 0-5 age group was particularly affected by illnesses inside the dwelling because they were not allowed to play far from the dwelling. Overall the prevalence of flood related illnesses was higher in children of the lowest age group (0-5) groups. This should be a warning to city and health officials that the young age groups are most susceptible to flood-related illnesses.

### 6.2.5. Infrastructure and illnesses

The research findings revealed a correlation between poor housing and infrastructure conditions and flood-related illnesses in Barcelona. The dwellings in Barcelona did not have the potential to withstand repeated flooding. Upon further observation, the poorer the type of dwelling the less it was able to withstand repeated flooding and the more children were exposed to flooding and its related illnesses. These findings were consistent with the work done by Ziervogel and Smit (2009) in Cape Town, who indicate that the poor construction practices of informal settlement

dwellings pose health risks to its inhabitants, especially children. Roads in Barcelona were poorly constructed, they were dusty, rugged and untarred. Thus, during the flooding periods the potholes are filled with stagnant fecal-contaminated waters from the blocked toilets. As a result of lack of playing areas and no other walking routes, children are forced to walk or play in the contaminated waters, exposing them to illnesses. Dense dwellings in Barcelona resulted in blocked drains leading to the over flowing of dirty flood waters; once again they were a source of exposure for illnesses amongst children. The findings were similar to other studies which indicate that the poor housing and infrastructure conditions expose residents of informal settlements to a wide array of illnesses (Davis, 2006; Holloway and Roomaney, 2008; Sverdlik, 2011; UN-Habitat 2003).

The research findings highlighted that children were susceptible to flood-related illnesses because the City of Cape Town and the community of Barcelona had no explicit strategies to reduce the health risk of children in informal settlements. In addition, it was perceived by the caregivers that were inadequate health care facilities in the area. Points raised in the focus group discussions included the assertion that the clinic and the hospital sometimes run out of medication because the medication is free. Some of the caregivers reported that during the winter season chances of getting medication are low. The City of Cape Town should therefore increase the supply of medication to informal settlements during the winter period.

Most of the caregivers in Barcelona were aware of the dangers that were related with residing in Barcelona, but because they could not migrate to other areas, because of lack of resources, and the fact that they were comfortable already and they were not sure if the government was able to provide them with accommodation if they migrated to new areas, they chose to put their lives and the lives of their children at risk of flooding and its health effects. These research findings are comparable to much of the body of work on slums and health, for example, the review by Sverdlik (2011) which concludes that informal settlements pose severe dangers to the health of their residents.

### 6.2.6. Personal hygiene

Research observations emphasized that poor personal hygiene was a factor that resulted in high occurrence and propagation flood related illnesses in children of Barcelona. Bathing of children after playing outside with contaminated waters played a part in reducing the probability of a child contracting skin diseases that were flood related. Thus efforts to practice personal hygiene in a household reduced the incidence of flood-related illnesses. As earlier research indicated (Fay, 2005, Few and Matthies 2007), personal hygiene has an influence on health, thus households that practice good hygiene are more likely to have a healthy life as compared to those who do not.

## ***Research objective 2****: To explore and identify the flood-related childhood illnesses*

### 6.2.7. A census of childhood flood-related illnesses

The findings that emanate from the research question highlight that there is a correlation between the impacts of flooding and child health. The adverse impacts of flooding on child health were detected through the types of illnesses children experienced. The flood-related childhood illnesses that were identified were illnesses such as respiratory illnesses, gastrointestinal illnesses, skin and ear infections, vector-borne diseases and other flood-related illnesses. The classification of the "other" types of illnesses is due to the fact that it was difficult for the caregivers to pinpoint the exact type of illnesses that children under the age of five experienced, and it also included symptomatic types of illnesses such as headaches and fevers that were not directly a result of flooding. The above types of illnesses are consistent with the types of illnesses found in the work of Fewtrell and Kay (2006). However, they differ in that Fewtrell and Kay include injuries and mental illnesses. This thesis did not include injuries and mental illnesses because the researcher did not have instruments to measure mental illnesses and injuries were not part of the objectives of the study. The research findings on types of flood-related illnesses were also similar to those of scholars like Alderman et al. (2012), DiMP (2005), Bunyavanich et al. (2003), Jakubicka et al. (2010) and Ahern et al. (2005).

To the researcher's surprise, the study revealed that respiratory illnesses were the most common type of flood-related childhood illness. The findings were surprising because a large body of

work documents gastrointestinal illnesses (diarrheal illnesses) as the most prevailing type of flood-related illness (Watson et al. 2007; Chinyenze-Daniel, 1999; Bility and Onya 2000; Benajmin, 2005 and Tapsell et al. 2002). This could be attributed to the fact that caregivers were taught how to administer Oral Rehydration Therapy during their visits to clinics and hospitals. In addition the preparation and administering of Oral Rehydration Therapy was also printed on their young children's *Road to Health* booklets.

Factors that contributed to respiratory illnesses being the most frequently occurring type of illness were the cold temperatures that were associated with the winter rains in Cape Town, children playing outside without warm and protective clothing, and the extreme coldness of the poorly insulated dwellings.

## ***Research objective 3:*** *To identify strategies households apply in order to protect their children from flood-related illnesses*

### 6.2.8. Measures to reduce the incidence of illnesses

The different households had different recovery patterns following a flood. Some households recuperated faster as compared to others because of differences in capital bases, social networks and availability of other resources. Nevertheless, the recovery rate seemed to be slow. The research findings were similar to the work done by Wisner et al. (2004), who highlighted that lower recovery rates might be related to poor social networks, low resource base, lack of knowledge.

The community of Barcelona applied a variety of coping strategies in order to reduce the vulnerability of children to flood-related childhood illnesses and to make them resilient to flood-related impacts. These coping strategies were applied by the caregivers and the older children. Nevertheless, the caregivers were left with the largest burden of taking care of the ill children. The variety of adaptive strategies applied included simple actions such as bathing the child after playing outside, carrying young children on the back during flooding, temporarily moving children to a relative's home, keeping one's house clean, and purchasing medication before and after flooding. The adaptive measure of temporarily moving children to a relative's place is consistent with one of the many adaptive measures outlined in the study of the five African cities by Douglas et al. (2008). In part, older children were also responsible individuals who took care

of themselves and their younger siblings. Older children had certain adaptive measures that they applied to protect themselves from flood-related illnesses; these included avoiding contaminated floodwaters and restricting their younger siblings from playing in contaminated floodwater.

Most of the caregivers indicate that most of their coping strategies had minimal effect on the occurrence or incidence of flood related childhood illnesses. For this reason, the adaptive and mitigation measures that were applied in Barcelona need to be developed further.

## 6.3. RESEARCH GAPS

The literature review highlighted that there is a limited number of flood-related health impact studies, as supported by the works of Few and colleagues (2004). This was further supported by Hajat et al. (2003), who indicated that there is little quantitative data that investigates flood-related health issues. Authors like Unger and colleagues (2007:6) indicate that "*Little is known about the spectrum and burden of disease morbidity in urban slums of the world*"

There is therefore a need for more studies which focus on the impacts of flooding on child health in informal settlements and slums.

## 6.4. CONCLUSION

In summary, the study documented the flood-related illnesses of children in Barcelona, and the health impacts were widespread and complex. The research found that there is a significant association between child health and flooding in Barcelona. The more children were exposed to flooding the more they were likely to contract illnesses.

The types of illnesses that were reported were mainly water-related illnesses, which included respiratory illnesses, gastrointestinal illnesses, skin and ear infections, vector-borne illnesses and other flood-related illnesses. Surprisingly, children suffered mainly from respiratory infections as compared to the expected diarrheal illnesses, as reported by a vast array of literature (Watson et al. 2007; Chinyenze-Daniel, 1999; Bility and Onya 2000; Benajmin, 2005 and Tapsell et al. 2002). The exposure routes of the above mentioned illnesses were through inhalation, followed by ingestion (especially among the infants and toddlers), and lastly through wound infections.

Overall, most children in Barcelona suffered from flood-related illnesses, highlighting the need to safeguard children from flood-related threats to their health. In order for the threats to be decreased there is a need to address the underlying risk factors (Creel, 2002). Floods are inevitable, but the incidence of flood-related illnesses can be mitigated through the creation and promotion of healthy living and playing conditions (WHO, 2005). In the case of Barcelona and other informal settlements in Cape Town, the interventions for flood-related health issues will help the government of South Africa to meet the Millennium Developmental Goals of eradicating extreme poverty and hunger, reducing child mortality, and ensuring environmental sustainability. In addition, provision of better housing and safe drinking water and sanitation is essential in curtailing flood-related childhood illnesses (WHO, 2004). Lastly, in order to decrease the risk factors for flood-related illnesses in children there is a need for an inter-disciplinary approach from the government.

The findings echoed the vulnerability of children to flood-related illnesses. However, vulnerability differed from child to child and house to house. An association between age, sex, poor housing conditions and location of risk increased the risk of contracting a flood-related illness. For this reason, different developmental stages have to be understood in order to develop policies that will protect children from flood-related illnesses: the younger the child the more vulnerable he/she was to flood-related illnesses.

By clarifying the types of illnesses that affected the children in Barcelona following floods, this study highlights the potential areas for improvement and solutions for the future.



## 6.5. RECOMMENDATIONS

This section of the thesis contains recommendations directed at caregivers, community members and local government with regards to actions that they can take in order to reduce childhood flood-related illnesses in Barcelona.

### 6.5.1. Recommendations to caregivers and community members

Caregivers and community members should be encouraged to practice good hygiene during and after flooding in order to reduce the prevalence of childhood flood-related illnesses. For instance, they can use vinegar to remove mould from their living spaces. Secondly, there is a need for

caregivers to identify the hidden environmental factors that lead to the increase of flood-related childhood illnesses in Barcelona. In addition, older children should be made junior safety marshals who will help to warn their caregivers and other children about the flood dangers. At the same time, caregivers should encourage their children to wear warm and protective clothing during the winter periods.

### 6.5.2. Recommendations to local government

First and foremost, the processes of flood risk reduction should be done in a participatory manner. The community should be involved in infrastructural development. In addition, affected communities should be consulted and even the children should be consulted, considering that they are the ones who are mostly at risk of flooding.

Importantly, floods are inevitable in Barcelona and most other informal settlements in Cape Town. Nevertheless if there are proper urban planning solutions such as effective storm water drainage, these could reduce the health impacts of flooding. Proper houses and adequate service delivery can help households to be more resilient (Benjamin, 2005). Work by Huq et al (2007) highlights that municipalities have the power to reduce vulnerability and poverty, this can be achieved through providing informal settlements with basic services such as adequate sanitation, water, housing, solid waste removal and drainage. In addition, the government should also learn from the example of "Living with Floods" policy that was implemented in the Mekong Delta, Vietnam. The aforementioned approach acknowledges that one cannot completely control floods, however the government should help teach the residents of flood-prone areas to co-exist with the floods (Few and Matthies, 2006).

The City of Cape Town should be able to properly time their health promotion activities in order that it reaches every member of the community. This implies conducting the health promotions during the weekends or even after working hours in order to accommodate the working population. This will be helpful to the caregivers because most of them are not properly equipped with the right information that can help them to minimize their children's exposure to contaminated floodwater and to the growth of mould in dwellings. Furthermore, the nurses, doctors, and health specialists should assist the caregivers in how to access information on both traditional and modern medication that can treat the less serious illnesses such as skin infections

(Few and Matthies, 2006). Lastly, the government should include content on flood-related health impacts and flood risk in the educational curriculum of South African children.

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# Appendix 1

## Flood and Health research Survey: Barcelona.

**Name of settlement** _____

**Shack number**

**Surname** _____ **Name**_____

**Gender:** Male ☐ Female ☐

**Age:**_____ **Home language** _____

1. In what year did you move to Barcelona? _____
2. Where were you living before you came here? _____
3. Why did you move to Barcelona? _____

_____

4. What is the condition of your house? Good ☐ OK ☐ Poor ☐
5. Construction Material of your house: Bricks ☐ Concrete blocks ☐ Wood ☐ Iron sheets ☐ Other_____
6. Is your house suitable for all weather conditions? Yes ☐ No ☐
7. If no, explain the problems: _____

_____

8. Were you aware of the risk of flooding before you built your house here? Yes ☐ No ☐

   If yes, why did you still build the house here? _____

_____

9. Do you think you are at risk of flooding? Yes ☐ No ☐

10. If yes, please explain why? _____

_____

11. Have you ever experienced flooding in your house? Yes ☐ No ☐

12. If yes, how many times? _____

13. What sort of flooding have you experienced?

Water rising through floor ☐ Water leaking through roof/ walls ☐

Water flowing into dwelling from outside ☐ Water washing dwelling away ☐

14.

| **Height of flooding** | | | | |
|---|---|---|---|---|
| **Location** | Ankle high | Knee high | Waist high | Other |
| Dwelling | | | | |
| Neighborhood | | | | |

15. For how long did it stay flooded?

0-12 hours ☐ 12-24 hours ☐ 24+hours ☐

16. Have you ever had to take days away from work after flooding? Yes ☐ No ☐

17. If yes, on average how many days during the winter period? ☐

18. Please, explain why you take these days away from work? _____

_____

19. Please highlight the types of furniture that has been destroyed by flooding:

T.V ☐ Radio ☐ Bed ☐ Sofas ☐ Others ?_____

20. How much in Rands does it cost you to acquire the type of property destroyed? _____

21. Are you given any warnings before major storms or flood risks? Yes ☐ No ☐

22. If yes, who warned you? _____

23. If you were asked to relocate, would you move? Yes ☐ No ☐

24. If yes, where to and why? _____

_____

25. What do you suggest City Council/Government should do to reduce the risk of flooding in Barcelona? _____

_____

26. What type toilet do you use? Communal toilet ☐ House toilet ☐ Other? _____

27. How many people use this toilet? ☐

28. Is the toilet in good condition? Yes ☐ No ☐

29. How far is the toilet from your house?

Less than 5m ☐ 5-20m ☐ More than 20m ☐

30. Where do you get your drinking water?

Private tap ☐ Communal tap ☐ Other? _____

31. How many times is the refuse collected in your community?

1 x week ☐ 2 x week ☐ 1 x month ☐

2 x month ☐ Never ☐ Other ☐

32. Is it often enough? Yes ☐ No ☐

33. What illnesses have your children had while living in Barcelona that are a result of flooding?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cholera | ☐ | Typhoid | ☐ | Hepatitis | ☐ | T.B | ☐ |
| Malaria | ☐ | Rash | ☐ | Asthma | ☐ | Cold | ☐ |
| Cough | ☐ | Eczema | ☐ | Skin infections | ☐ | Ringworms | ☐ |
| Headaches | ☐ | Runny noses | ☐ | Diarrhea | ☐ | Fever | ☐ |
| Flue infection | ☐ | Tonsillitis | ☐ | Stomach p | ☐ | Ear | ☐ |
| Nose infection | ☐ | Throat infection | ☐ | Other? | _____ | | |

34. What exactly about floods do you think causes these illnesses?

| | | | |
|---|---|---|---|
| Playing in dirty water | ☐ | Drinking dirty water | ☐ |
| Mould in the house | ☐ | Floodwaters in the house | ☐ |
| Dampness in the house | ☐ | flood water around the house | ☐ |

Other _____

35. How long do your children get sick for after flooding? _____

36. Where do your children sleep during the winter period:

Floor ☐ Bed ☐ Sleep somewhere ☐ Other ☐

37. Where do your children play during winter/rainy periods?

| | **PLAYING AREA FOR BOYS** | | | | | | |
|---|---|---|---|---|---|---|---|
| **AGE** | Home | Crèche | aisles between dwellings | Road | Play ground | Canal | School |
| 0-6 | | | | | | | |
| 7-12 | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 13-18 | | | | | | | |

**PLAYING AREA FOR GIRLS**

| **AGE** | Home | Crèche | aisles between dwellings | Road | Play ground | Canal | School |
|---|---|---|---|---|---|---|---|
| 0-6 | | | | | | | |
| 7-12 | | | | | | | |
| 13-18 | | | | | | | |

38. Did your children have prior illnesses in months before the flooding? Yes ☐ No ☐

39. If yes, what sort of illnesses?_____

40. What health facilities do you use? Hospital ☐ clinic ☐ Traditional healer ☐

General practitioner (G.P) ☐ Emergency services ☐ Others _____

41. What is the name of the facility (e.g) Khayelitsha hospital) _____

42. After how long do you take your children to the place you have indicated above?

Immediately when they get sick ☐ after some time ☐ when they get worse ☐

Please explain why _____

43. Are the above facilities adequate? Yes ☐ No ☐

**Classification table**

| **Relationship to head of household** | **Sex** | **Age** | **Education level** | **Occupation** | **Type of employment** | **Income** |
|---|---|---|---|---|---|---|
| Head of household | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
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| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |

44. How much are the main expenses per month?

Food ☐ Electricity ☐ Transport ☐ Medicine ☐

Rent/Maintenance ☐ School fees ☐ Clothing ☐ Other _____

45. If unemployed, does any household member receive a welfare grant? Yes ☐ No ☐

If yes, which type of grant? (E.g.: disability, child support, pension, refugee…

_____

46. What measures do you think the city or government should put into place in order to help children during and after flooding? _____

_____

47. **Hazard adjustment**

| | **Hazard adjustment** | | | |
|---|---|---|---|---|
| **Forms of flooding** | What measures have you taken to protect your dwelling against | How effective are the measures | What is the cost of implementing such measures | Did you implement the measures on your own or with the help of outsiders |
| Wetland | | | | |
| Leakage | | | | |
| Ponding | | | | |

| | | | | |
|---|---|---|---|---|
| Seepage | | | | |
| Storm-water runoff | | | | |

48. What do you do to protect yourself from flooding as a neighborhood/community? _____

_____

49. Are the above measures effective? _____

50. How much does it cost you to implement such measures? _____

51. What has the community of Barcelona done to reduce the risk of flooding and protect their children from flooding illnesses? _____

_____

**Vulnerability adjustment**

52. Can you please state the measures taken by the actors below to reduce the exposure of children to flood impacts?

    i. Municipality: _____

    ii. NGO's/Business: _____

    iii. Community: _____

    iv. Household: _____

53. Is there any form of legislation that you are aware of, that protects you against flooding and its risks? _____

_____

54. Does your community have any rules and regulations that guides you on how to behave or live so as to avoid endangering you and your neighbors from flood risks? _____

_____

## Appendix 2

## FOCUS GROUP DISCUSSION AND WORKSHOP PLAN

### Central research question

Understanding the impact of flooding on child health in informal settlements: A case study of Barcelona, Cape Town, South Africa

### Introduction of the session and the need for the session

### Focus group questions

1. What is a flood?

**Materials:** Flip chart and markers. Individual sheets

**Aim:** Get a working definition of flood for group discussion.

**Individual activity:** Go around the room each person says what a flood is and it‘s written on flip chart

* Time allocation 20mins

2. What causes flooding?

**Materials:** Flip chart and markers

**Aim:** Get a working definition of causes of flooding for group discussion.

**Group activity:** Go around the room each person says what causes flooding and it‘s written on flip chart

* Time allocation 10mins

3. What sort of flooding have you experienced? How long and how often?

**Materials:** Flip chart and markers.

**Aim:** Getting to understand their perception of flooding

**Individual activity:** Go around the room each person says what sort of flooding they have experienced

1. What illnesses caused by flooding? Have your children ever suffered from them? For how long?

**Materials:** Flip chart and markers.

**Aim:** To understand the types of illnesses caused by a flooding.

**Individual activity:** Go around the room each person says what illnesses caused by flooding their children have suffered from. This will be written on flip chart

* Time allocation 20mins

2. What makes your children vulnerable to such illnesses?

**Materials:** Flip chart and markers.

**Aim:** Get a working definition of vulnerability to illnesses caused by flooding.

**Individual activity:** Go around the room each person says what makes their children vulnerable to flooding and it‘s written on flip chart

* Time allocation 10mins

3. What do you do to protect yourself and your family from flood waters?

**Materials:** Individual sheets and pencils.

**Aim:** To understand how they protect their children from flooding and its related illnesses

**Individual activity:** Draw what they do to protect themselves from flooding.

* Time allocation 10mins

4. What should be done to protect people/houses from flood water?

**Materials:** Work in groups -sheets and pencils.

**Aim:** have their perspectives of how they can be protected from floods and illnesses associated with flooding

**Group activity:** Write what they think should be done to protect them

* Time allocation 25mins

**SIGN-UP SHEET**

**Date:** **Start time:** **End Time:**

| Number | Name | Age | Gender | Were you born in Barcelona | Home language |
|---|---|---|---|---|---|
| | | | | | |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |